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TWENTY-FOURTH ANNUAL REPORT

OF THE

State Board of Health

OF THE

STATE OF OHIO

FOR THE

YEAR ENDING DECEMBER 31

1909

COLUMBUS, O.:
THE F. J. HEER PRINTING CO.
1910.

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Columbia
New York

LETTER OF TRANSMITTAL.

OHIO STATE BOARD OF HEALTH.

OFFICE OF THE SECRETARY.

COLUMBUS, OHIO, June 9th, 1910.

To His Excellency, JUDSON HARMON, *Governor of Ohio*:

SIR: — In accordance with Section 1248 of the General Code, the accompanying report, which is for the calendar year 1909, is herewith submitted.

Respectfully,
C. O. PROBST, M. D.,
Secretary.

MEMBERS OF THE OHIO STATE BOARD OF HEALTH.

*Byron Stanton, M. D., *President*, Cincinnati	December, 1909
J. C. Crossland, M. D., *Vice-President*, Zanesville	December, 1910
Wm. T. Miller, M. D., Cleveland	December, 1911
Frank Warner, M. D., Columbus	December, 1912
W. C. Chapman, M. D., Toledo	December, 1913
Josiah Hartzell, Ph. D., Canton	December, 1914
Darwin G. Palmer, M. D., Geneva	December, 1915
C. O. Probst, *Secretary*.	

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* January 17th, 1910, Mr. John W. Hill of Cincinnati was appointed to succeed Dr. Stanton.

GENERAL REPORT

This is the twenty-fourth annual report of the State Board of Health, and is for the year ending December 31st, 1909.

As the report embraces matters included in the annual reports of local boards of health, which are to be submitted on or before the fifteenth day of January of each year, there is necessarily some delay in its preparation.

PERSONNEL OF THE BOARD.

The personnel of the Board remains unchanged for the last year. The term of office of Dr. Byron Stanton, of Cincinnati, expired on December 13th, 1909, and his successor was not appointed until 1910.*

ANNUAL REPORT.

The various activities of the Board may be briefly summed up under the headings below.

Beginning January, 1909, the Board published a Quarterly Bulletin, superseding the Monthly Sanitary Record begun in 1888. It is the policy of the Board to publish reports of certain features of its work in the Quarterly Bulletin to which only brief reference will be made in its annual reports. This will serve to secure earlier publicity of matters that should be brought out promptly, and at the same time cut down the size of the annual reports.

CONTAGIOUS AND INFECTIOUS DISEASES.

SMALLPOX.

The outbreak of mild smallpox which appeared in the United States in 1897, and in Ohio in 1898, has never been entirely suppressed. This has been due to its mildness, which has been the cause of frequent mistakes in diagnosis; of the non-discovery of cases because no physician was called, and of general neglect of vaccination as the disease has caused but little public concern.

During the year smallpox was reported in 142 different communities, in 54 different counties. The total number of cases reported was 1328, with 4 deaths, a death rate of .3 of one percent. The distribution of cases is shown in the following table:

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*January 17th, 1910, Mr. John W. Hill of Cincinnati, was appointed to succeed Dr. Stanton.

CASES AND DEATHS FROM SMALLPOX REPORTED TO THE STATE BOARD OF HEALTH FROM JANUARY 1st TO DECEMBER 31st, 1909.

County.	*Place.*	*Cases.*	*Deaths.*
Allen	Sugar Creek Township	1	....
Ashtabula	Ashtabula	11	1
	Conneaut	2	....
	Geneva	6	....
	Geneva Township	1	....
	Saybrook Township	1	....
Athens	York Township	1	....
Auglaize	Salem Township	4	....
Brown	Jefferson Township	6	....
	Ripley	17	....
	Union Township	5	....
Butler	Hamilton	23	....
	Milford Township	3	....
	St. Clair Township	3	....
	Wayne Township	15	....
Clark	Bethel Township	1	....
	Springfield	12	....
Clermont	Batavia	1	....
	Jackson Township	7	....
	Miami Township	6	....
	Milford	1	....
	Stonelick Township	1	....
	Tate Township	1	....
	Williamsburg Township	12	....
	Williamsburg	9	....
Clinton	Clark Township	8	....
	Wilson Township	1	....
Columbiana	Lisbon	1	....
	Madison Township	1	....
	Salineville	46	....
Cuyahoga	Cleveland	6	....
Darke	Arcanum	7	....
	Butler Township	1	....
	Greenville	2	....
	Greenville Township	8	....
	Harrison Township	2	....
	Twin Township	1	....
	Washington Township	6	....
Franklin	Columbus	19	....
	Marion Township	1	....
Geauga	Auburn Township	1	....
Greene	Bath Township	6	....
	Osborn	76	....
	Xenia	2	....
Guernsey	Monroe Township	2	....
Hamilton	Cincinnati	269	2

CASES AND DEATHS FROM SMALLPOX, ETC.—Continued.

County.	*Place.*	*Cases.*	*Deaths.*
Hamilton — Concluded	Glendale	1	....
	Hartwell	1	....
	Lockland	1	....
	Loveland	1	....
	Oakley	2	....
	St. Bernard	2	....
	Symmes Township	12	....
Hancock	Amanda Township	2	....
	McComb	2	....
Hardin	Cessna Township	1	....
	Kenton	1	....
	Lynn Township	1	....
	Washington Township	7	....
Highland	Concord Township	1	....
	Dobson Township	6	....
	Hillsboro	63	....
	Jackson Township	1	....
	Leesburg	7	....
	Liberty Township	16	....
	Lynchburg	1	....
	Marshall Township	2	....
	New Market Township	4	....
	Paint Township	9	....
	Salem Township	1	....
	Sinking Spring	1	....
	Union Township	1	....
	Washington Township	1	....
Holmes	Glenmont	1	....
Huron	Norwalk	1	....
Jefferson	Brush Creek Township	2	....
Knox	Pike Township	3	....
Lawrence	Fayette Township	1	....
Logan	Bellefontaine	1	....
	Bokes Creek Township	2	....
Lorain	Lorain	1	....
Lucas	Toledo	3	....
Madison	Canaan Township	4	....
	Jefferson Township	2	....
	Monroe Township	5	....
	Pike Township	3	....
	Plain City	55	....
Marion	Marion	1	....
Mercer	Butler Township	1	....
Miami	Monroe Township	12	....
	Newton Township	1	....
	Tippecanoe City	1	....
	West Milton	2	....

CASES AND DEATHS FROM SMALLPOX, ETC. — Continued.

County.	*Place.*	*Cases.*	*Deaths.*
Montgomery	Dayton	37	1
	Harrison Township	5	....
	Madison Township	3	....
Morrow	Canaan Township	13	....
	Gilead Township	5	....
	Mt. Gilead	1	....
Perry	Crooksville	8	....
	Harrison Township	1	....
Pickaway	Pickaway Township	5	....
Pike	Jackson Township	12	....
	Pee Pee Township	4	....
	Seal Township	10	....
	Waverly	1	....
Preble	Eaton	1	....
	Harrison Township	1	....
	Monroe Township	2	....
	Washington Township	5	....
Putnam	Blanchard Township	1	....
	Ottawa Township	1	....
	Union Township	5	....
Ross	Chillicothe	3	....
	Green Township	5	....
	Jefferson Township	1	....
Sandusky	Madison Township	3	....
Scioto	Portsmouth	1	....
Seneca	Clinton Township	27	....
	McCutchenville	1	....
	Tiffin	3	....
Shelby	Sidney	11	....
Stark	Perry Township	1	....
Trumbull	Warren	2	....
Tuscarawas	Canal Dover	1	....
Union	Jerome Township	20	....
	Union Township	1	....
Van Wert	Jennings Township	2	....
Warren	Union Township	1	....
Wayne	East Union Township	1	....
	Dalton	1	....
	Green Township	2	....
	Sugar Creek Township	5	....
	Orrville	18	....
Williams	Stryker	2	....
Wood	Freedom Township	3	....
	Bowling Green	5	....
Wyandot	Carey	23	....
	Crane Township	9	....
	Crawford Township	5	....
	Eden Township	2	....

CASES AND DEATHS FROM SMALLPOX, ETC. — Concluded.

County.	*Place.*	*Cases.*	*Deaths.*
Wyandot — Concluded	Mifflin Township	16	....
	Ridge Township	1	....
	Salem Township	15	....
	Sycamore	1	....
	Tymochtee Township	15	....
	Upper Sandusky	35	....
Counties, 54.	Places, 142.	1328	4

The Board has made thirty inspections on account of smallpox, and by telegram, telephone, letters, and printed instructions, has given all possible aid to local authorities.

A source of much dissatisfaction has been numerous outbreaks of smallpox among gangs of railroad laborers brought in from other states. The local authorities have had to take charge of such outbreaks at considerable expense, which has caused much complaint.

In one instance the local authorities refused to act and it became necessary for the State Board of Health to assume complete charge. The outbreak was promptly suppressed and a bill of expenses necessarily incurred was rendered to the local authorities, as provided by law. This also caused dissatisfaction and the bill was rejected. It can probably be amicably adjusted.

The Attorney General gave an opinion that the railway company that brought these laborers into the state could not be held responsible for the expenses of handling the outbreak. If constitutionally permissible, a law should be enacted to hold railway companies and others responsible for necessary expenditures in such cases.

We have every reason to expect outbreaks of smallpox to occur from time to time so long as vaccination is generally neglected. The Supreme Court of Ohio has decided that boards of education have authority to require all children who attend school to be vaccinated whether smallpox be present at the time or not. In our larger cities this rule is pretty generally enforced, but it is almost entirely neglected in villages and rural districts.

DIPHTHERIA.

Full reports of cases of diphtheria have not been made. There were 604 deaths from the disease reported to the State Bureau of Vital Statistics during the year.

There is every reason to believe that the greater number of these children might have been saved by the prompt use of antitoxin. Our laws for the distribution of antitoxin are inadequate. Our county commissioners, or local board or health *may* furnish antitoxin in *indigent* cases. A too strict interpretation of the word "indigent" has sacrificed many lives.

It cannot be over emphasized that in antitoxin we have the best means for the *prevention* of diphtheria. If the health authorities would see to it that all exposed children were immunized as soon after the first case was reported as possible, a very large number of cases would be prevented.

The greatest protection the public could have against diphtheria would be found in the free and general distribution of antitoxin to all who need it.

The price of antitoxin for curative purposes, as supplied through commercial channels makes it often prohibitive to a poor man, who would not be classed as indigent by the local authorities, and who, from just pride, might not be willing to be so classed. This expense in a single case might exceed a hundred dollars.

As noted in a former report, this Board has established stations in each county, 276 in all, where antitoxin is kept and which may be ordered and paid for by local authorities for free use in indigent cases. This is sold at materially reduced rates to local boards of health.

It is believed that the state should purchase or manufacture antitoxin for free distribution to all as the most effective method for combating this disease. This plan is being successfully followed in other states, with a marked lowering of the death rate from diphtheria as the result. This Board recommends that such legislation be enacted.

TYPHOID FEVER.

There were 1,261 deaths reported to the Bureau of Vital Statistics in 1909. Fourteen outbreaks were investigated by the Board, in the following places: Batavia, Girls' Industrial Home at Delaware, Greenville, Germantown, Holloway, Israel Township, Preble County and Oxford Township, Butler County; Mansfield, Mansfield Reformatory, Niles, Oberlin, Rocky River, Roscoe and Willoughby.

Such assistance as possible was given to the local authorities in the enforcement of measures for prevention, and in searching for the cause of the outbreak.

Too much stress, possibly, has heretofore been laid upon water as the channel through which typhoid germs are communicated. While contaminated water probably plays the principal role, there are numerous other ways through which this disease may be contracted, and which are often overlooked. The Board has adopted a blank giving minute information concerning each case which local authorities are requested to have fully filled out. These are of great aid in tracing the source of an outbreak.

TUBERCULOSIS.

Tuberculosis is occupying greater public attention than any other disease. The State Board of Health has co-operated as fully as possible with the various local agencies organized for defense against it.

On October 27th, 1909, the State Sanatorium at Mt. Vernon was formally opened with the following program:

FORMAL OPENING.

OF THE

OHIO STATE SANATORIUM FOR TUBERCULOSIS.

Presentation of Keys to Board of Trustees . . .	Governor Judson Harmon
Response for the Trustees	Dr. S. P. Wise. President.

SHORT ADDRESSES

By

Ex-Governor Myron T. Herrick,
Ex-Governor Andrew L. Harris,
Dr. C. O. Probst.

MEETING OF THE OHIO SOCIETY

For The

PREVENTION OF TUBERCULOSIS.

Address of Welcome	Dr. J. H. Lowman, President.
Centralization in Tuberculosis Work	Dr. Wm. Charles White, Medical Director of Tuberculosis League, Pittsburg.

This institution, which the Board was instrumental in bringing about, will become more and more helpful in combating this disease. It should not be lost sight of that the sanatorium while chiefly for the cure of early cases, will soon become, as an educational center, a potent means for teaching prevention.

The Act prepared by the Board for County and District Hospitals for Tuberculosis is meeting with much favor. The Board has approved the location and plans for such hospitals for the counties of Franklin, Lucas and Summit. Also location and plans for a District Hospital for the counties of Allen, Auglaize, Mercer, Shelby and Van Wert; Montgomery and Preble counties are operating a District Hospital taken over by them, near Dayton. Hamilton and Cuyahoga counties had already provided tuberculosis hospitals. Numerous conferences have been held with commissioners of other counties where the question is being considered.

Hospital care for advanced cases offers our best means for limiting the ravages of this disease, and it is to be hoped that each county will soon have a suitable place for such cases.

Anti-tuberculosis societies have been organized in Cleveland, Cincinnati, Columbus, Toledo, Akron, Youngstown and Canton; and all of them are doing good work in the prevention of this disease.

The Board would renew its recommendation that it be given an appropriation for a Traveling Tuberculosis Exhibit, as experience in other states has shown this to be the best means to educate the public in measures for its prevention.

WATER SUPPLIES AND SEWERAGE.

The duty of looking after water supplies and sewerage brings much important work before the Board. The Engineering Department has now collected a mass of data on water and sewerage purification that is often of value to designing engineers and local authorities. Consultations with these in regard to proposed improvements of this character are of increasig frequency. The Board is also being called upon to assist in forming public setiment in favor of these utilities by having some one from the department address public meetings where such questions are being considered. It has been the constant aim of the Board to place itself in a helpful attitude to all communities having to deal with problems relating to water, sewerage or waste disposal.

The Board is following up with more frequency than heretofore new works of this character being built. Forty-six such inspections were made this year. Not infrequently it is found that the work is not being properly constructed, is of poor workmanship, or that changes in plans are being made that are undesirable. Proper notice of such findings is given to the local authorities.

During the year the Board has passed upon plans relating to water or sewerage in 51 places, as follows:

Water—Akron, Apple Creek, Barnesville, Blanchester, Cedar Point, Dayton, Delaware, Delta, East Liverpool, Huron, Ironton, Lewisburg, Logan, Madison Home, Pleasant Hill, Portsmouth, Put-in-Bay, Roseville and Crooksville, St. Henrys, Swanton, Urbana, Willoughby and Zanesville.

Sewerage—Alliance, Archbold, Athens, Auglaize County Infirmary, Carthage, Covington, Elmore, Elmwood Place, Jackson, Jefferson, Linden Heights, Louisville, Madison Home, Marble Cliff, Massillon Foundry & Machine Co., Middletown, Monroeville, Mt. Gilead, Niles, Oberlin, Oxford, Vermilion, Warren, West Lafayette, West Milton, Wilberforce University, Xenia O. S. and S. O. Home, and Youngstown.

Water purification plants have been constructed or are being constructed at Ashtabula, Bellaire, Camp Perry, Cedar Point, Huron, Ironton, Sandusky and Toledo.

Sewage purification plants have been introduced or are being constructed in Akron, Alliance, Auglaize County Infirmary, Camp Perry, Chagrin Falls, College Hill, Eaton, Elmwood Place, Hartwell, Jefferson, Lockland, Home for The Ohio Soldiers, Sailors, Marines, etc., at Madison, Methodist Home for the Aged at College Hill, Mt. Gilead, Mt. Vernon, State Sanatorium; Oberlin, Orrville, Oxford, Sylvania, Wilberforce University, Wyoming and the O. S. & S. O. Home at Xenia.

Existing plants have been kept under observation, 30 inspections of water and 20 of sewage purification plants having been made during the year. More frequent inspections, especially of the smaller plants with no laboratory control of their own, is desirable, but was not possible with present engineering assistance.

MAHONING RIVER.

A somewhat remarkable conference was held in Warren, Ohio, on August 5th, 1909. So far as known this is the first time that all the communities living upon the banks of a stream have met, by representatives, to consider their mutual interests in, and responsibilities for preserving, the purity of the stream.

For the past year the State Board of Health had been making sanitary studies of the Mahoning River. A detailed report of the results of this investigation is given later on. The Board, hoping to bring about an *entente cordiale* between the various communities of the Mahoning River valley, and to unite them in a common cause in preserving the river from dangerous pollution, issued an invitation to the authorities of each city and village on the river to meet the Board in Warren for the purpose of discussing the question in a general way. About eighty representatives of the various towns were present.

A general review was given of the various past actions of the State Board of Health in regard to propositions concerning either water or sewage that had been presented to the Board by different Mahoning River towns. A report was then made of the varying conditions of the Mahoning River at different places and at different seasons, as regards its pollution, as shown by the special investigation of the Board.

A general discussion of sewage disposal followed.

What the outcome of the conference will be is unknown. It is hoped that it created a feeling of unity of interest of the various communities represented, and that it will make it easier for the State Board of Health to properly adjust the many conflicting questions as regards water and sewage for the various Mahoning River towns which are now and are soon to be before it.

BENSE ACT.

Complaints were made under the Bense Act as follows:

By the board of health of Akron that the public water supply of the city of Akron was impure and dangerous to health.

By the health officer of Bellaire that the public water supply of the city was impure and dangerous to health.

By the authorities of Pulaski Township, Williams County, that the village of Bryan, by discharging sewage and other wastes into streams and ditches flowing through the township, was creating conditions detrimental to the health and comfort of those residing in the vicinity of said streams and ditches.

By the commissioners of Crawford County, on complaint by land owners residing in the vicinity of the Sandusky River within the county, that the city of Bucyrus by discharging sewage into said river was creating a public nuisance detrimental to the health and comfort of the people of the community.

By the health officer of Collinwood that the village, by discharging sewage and other wastes into Rockefeller Creek, was creating conditions detrimental to the health and comfort of the citizens of Collinwood.

By the authorities of Jackson Township, Darke County, that the wastes from the creamery of J. A. Long & Company at Union City was polluting certain ditches and thereby giving rise to conditions detrimental to the health and comfort of the citizens of said township.

By the board of health of Dayton that the public water supply of that city was being contaminated by the discharge of wastes from the plants of The Wuichet Fertilizer Company and The Dayton Reduction Company.

By the board of health of Ironton that the public water supply of that city was polluted and dangerous to health.

By the board of health of New Philadelphia that the sewage of that city emptying into the Tuscarawas River was so polluting the river as to produce conditions detrimental to the health and comfort of those residing in the vicinity of the sewer outlets.

By the board of health of Niles that the public water supply was inadequate and when supplemented by raw water from the Mahoning River highly polluted.

By the council of Niles that the discharge of sewage and other wastes into Mosquito Creek was giving rise to conditions detrimental to the health and comfort of the citizens residing in the vicinity of said creek.

By the authorities of Carlisle Township, Lorain County, that the sewage of Oberlin was polluting Plumb Creek.

DISPOSAL OF GARBAGE.

The special investigation of the disposal of garbage and other city wastes has been continued through the year. The laboratory examinations of these products will be kept up for a few months longer. The data collected, which will be of value to all cities, will then be utilized for a special report on this important problem in municipal sanitation. A partial report of the work has been published in the Quarterly Bulletin, Volume 1, Number 2.

OHIO RIVER.

The Ohio River Sanitary Commission, appointed at the request of the State Board of Health but independent of it, is now fully organized. Two joint meetings have been held, at which representatives from all the states were present, viz., Pennsylvania, West Virginia, Kentucky, Indiana and Ohio. An engineering investigation of the sources of pollution of the Ohio River has been made and was published in the Quarterly Bulletin of the Board. Volume 1, Number 4.

A committee is working on a uniform bill looking towards the gradual cleaning up of the river, which is to be offered to the respective legislatures of the states represented.

LYING-IN HOSPITALS.

A full report of the work imposed upon the Board of examining and licensing lying-in hospitals and maternity boarding houses is given further on. Thirty-six such institutions were licensed and eleven were refused a license. This refusal put out of business the worst class of such places.

Some amendments are needed to the act under which this work is being done. At present it is possible to dispose of an unclaimed infant without any legal formalities. We shall ask that this be made impossible. The act needs strengthening in other particulars.

LABORATORY.

The work in the laboratory has grown from year to year. Four thousand, five hundred and eighty-five examinations were made during the past year. There has been a large increase in examinations made for physicians for diagnostic purposes.

An unusually large number of dogs were examined for suspected rabies; 143 in all, of which number 82 were shown to have been rabid.

While rabies in human beings is quite rare, no disease, probably, is more dreaded by the public. The present law authorizing county commissioners to pay $500 for the Pasteur treatment of persons bitten by a rabid animal is doubtful in principle because, while a person with rabies might transmit the disease to other persons, this is of such unlikely occurrence that it can hardly be claimed that the Pasteur treatment is for the prevention of disease, except in the individual treated. In this respect rabies is entirely different from diphtheria, for which free antitoxin for rich and poor is recommended. In rabies it would seem proper that at the most, preventive treatment should be furnished free only for the indigent.

PROCEEDINGS OF THE BOARD.

The proceedings of the Board at its various meetings are set forth in sufficient detail and made a part of this report. The proceedings of the annual conferences with local boards of health were printed in the Quarterly Bulletin. A full account of the various matters that have demanded the attention of the Board may be found under appropriate headings in the body of the report.

REPORTS OF LOCAL BOARDS OF HEALTH.

An attempt was made to get information bearing upon the character and amount of health work done in villages and townships during the year. There is reason to believe that in many of these but little attention is given to health matters.

In the first place only 377 out of a total of 770 villages in the state, replied to the circular asking for such information, showing a lack of proper interest.

The amount of money expended is a fairly good index of the amount of work done, although it is true that much is done in this line for the public for which little or no compensation is received.

In 359 villages, with a total estimated population of 435,417, there was spent by boards of health for the year, $39,099.88. This is an average of about $109 per village, and of less than 9 cents per capita. The largest amount spent in any of these villages was $6,633.48, and the smallest $1.15. In 18 of these villages, with an estimated population of 9,000, nothing was expended in health work.

Three hundred and thirty-nine villages paid their health officers $17,332.40, an average of about $51.00. In 38 villages health officers served without pay.

Forty-seven villages purchased diphtheria antitoxin, at a total cost of $537.55.

Fairly good work is shown in the abatement of nuisances. In 213 villages there were 3,700 nuisances abated. One hundred and thirteen villages reported one hundred and thirty-nine slaughter houses within corporation limits.

One hundred and forty of these villages have public sewers, and in 24 of them they create a nuisance at times.

In only 12 of the villages reporting are dairymen licensed to sell milk. No license is required in the others.

There are 547 school houses in the villages reporting, and 453 inspections were made by the board of health, which means that a few of them were inspected more than once. This is a fair showing although the law requires such inspections to be made semi-annually.

TOWNSHIP BOARDS OF HEALTH.

Eight hundred and fifty-eight townships reported out of 1,351. In 581 of these there was spent in health work $28,868.70, or a little less than $50 per township. In 277 no expenditures were made for this purpose.

In 257 townships the total amount paid for salaries for health officers was $9,470.13, or about $37.00 on the average. The largest salary paid was $425.00, and the smallest $1.50. In 237 townships health officers are paid by the day, or by fees, and in 364 nothing is paid.

Sixty-six townships paid out $895.15 for diphtheria antitoxin.

In 435 townships it is reported that 1,721 houses were quarantined on account of infectious disease. In 604 townships physicians reported such diseases promptly, but in 104 physicians had failed to make such reports.

These reports would indicate that there is much need for the better enforcement of health measures in the small villages and rural districts.

MINUTES OF THE SECRETARY

RESUMÉ OF QUARTERLY REPORTS.

JANUARY MEETING.

A regular meeting of the State Board of Health was held at the office of the Secretary in Columbus at 2 P. M., Wednesday, January 20th, 1909.

There were present Dr. Stanton, in the chair; Drs. Chapman, Warner and Palmer.

The meeting was called to order by the President.

The Secretary stated that petitions had been received under the Bense Act, making complaint of pollution of certain streams by sewage and other waste products from the following municipalities, to-wit: Marysville, Elmore, Cambridge, and also the pollution of a stream by the waste products from The Ohio Box-board Company, at Rittman, and the pollution of Bridge Creek by the sewage from the infirmary of Darke County. These complaints had been investigated and reported upon by committees of the Board, and those concerned had been notified of the findings of the Board in these cases, and that a public hearing would be held at 2 P. M. on this day.

Thereupon, the President asked that representatives from Marysville should present their case. The following representatives from Marysville were present, namely: J. T. Cartmell, mayor; J. H. Kinkade, city solicitor; J. C. Kennedy, city engineer; Dr. C. Hoopes, health officer; Pearl McElroy, councilman; Charles Armstrong, councilman; W. S. Peel, councilman; E. F. Sawyer, councilman; Samuel McIntire, councilman; William Snodgrass, councilman; George W. Whitney, Dr. A. B. Swisher, J. C. McCampbell, E. H. Courtright, H. W. Morey and R. L. Woodburn.

After full hearing with stenographic report thereof, on motion of Dr. Chapman, duly seconded, the question as to the action to be taken in the case of Marysville, was referred to executive session.

The President then called for representatives from Elmore. The following persons were present, namely: J. G. Steinkamp, mayor; Henry Pafenbach, citizen of Elmore, and W. Tanke, councilman.

These representatives were given a full opportunity to be heard in regard to conditions complained of, after which, on motion of Dr. Warner, duly seconded, the question of the action to be taken in regard to this matter was referred to executive session.

The President then called for representatives from Cambridge. The following persons were present: Mr. C. S. Turnbaugh, president of the board of health; Dr. W. N. Bradford, mayor, and O. M. Hoge, city engineer.

After giving them a full opportunity to be heard in reference to the complaint against Cambridge, this matter, on motion of Dr. Palmer, duly seconded, was referred to executive session.

The Secretary stated that representatives of The Ohio Box-board Company had asked permission to be heard on January 21st, 1909, at 9 A. M.

The Secretary also stated that a letter had been received from the commissioners of Darke County in regard to the complaint against the infirmary of said county, stating that it would be impossible for them to have a representative at this meeting.

Plans for a proposed sewer for the Fourth Ward of the city of Niles were presented by John S. Naylor, mayor; Fred Brewer, city engineer, and Luther Lewis, member of the board of health.

After some discussion these plans, on motion of Dr. Chapman, duly seconded, were referred to the engineer and Dr. Warner for investigation and report.

The minutes of the October meeting were then read.

On motion of Dr. Warner the minutes were approved.

The minutes of a special meeting, held December 9th and 10th, 1908, were read.

On motion of Dr. Palmer these minutes were approved.

The Secretary then presented his quarterly report.

On motion of Dr. Warner it was voted that the report be received and filed.

The Board then recessed to 8 o'clock P. M. of the same day.

SECOND SESSION.

The Board reassembled at 8 P. M. pursuant to adjournment.

There were present: Drs. Stanton, Warner, Palmer, Chapman and Crossland.

A delegation consisting of the president and some seven or eight members of the State Homeopathic Medical Society was present, and was heard in reference to certain provisions of the proposed bill for the appointment of a deputy state health officer for each county. It was urged that the bill, as drawn, discriminated against homeopathic physicians as well as eclectic physicians inasmuch as but very few of them are members of any regularly organized county medical association of their own schools. It was stated further that this provision of the bill had been presented to a competent attorney who had advised that it was unconstitutional. They asked that this provision of the bill be omitted. After a full discussion, it was voted to refer this matter to executive session.

A delegation of citizens from Zanesville appeared before the Board, and asked an opportunity to be heard in regard to a proposed new water supply for the city. The delegation consisted of the following: J. P. Rhinehart, president of the board of public service; C. J. Murdock, member of board of public service; E. M. Ayers, chairman of a committee of the chamber of commerce; J. Hope Sutor and C. J. Marshal, members of the chamber of commerce, and Dr. W. A. Melick, chairman of committee of Muskingum County Medical Society.

The Secretary read the report prepared by the special committee, Dr. Crossland, Dr. Warner and the chief engineer, on proposed water supply for Zanesville. Full opportunity was given for discussion of this report by those present, after which, on motion of Dr. Crossland, the question was referred to executive session.

The Board then went into executive session.

It was moved by Dr. Palmer and seconded by Dr. Chapman that the report of the special committee on the water supply for Zanesville be adopted, and that the Secretary be directed to send a copy of the communication to the board of public service as proposed in said report, and also a copy to council, with a statement that council should now adopt the plan proposed for a new water supply to be taken from wells, or some other plan, if council so desired, and return the same to the State Board of Health for final action to be taken at the first meeting of the Board, held after the receipt of said plans.

The motion was carried.

A recess was then taken to 9 A. M. the following day.

THIRD SESSION.

The Board met pursuant to adjournment, Thursday, January 21st, 1909.

There were present: Drs. Stanton, Warner, Palmer, Chapman and Crossland.

The complaint against the Ohio Box-board Company as regards the pollution of Chippewa Creek by the wastes from their factory at Rittman was taken up for consideration. Mr. W. F. Carr and Dr. Nathan S. Everhard were present, representing the company. They were given a full opportunity to be heard in regard to the complaint. They stated that such pollution of the stream as might have been caused by them was undoubtedly due to the escape of fine fibrous matter which they were desirous to retain as this meant a loss in operation. They further stated that they had already made arrangements to install screens which they believed would remove the cause of complaint.

On motion of Dr. Chapman, duly seconded, this matter was referred to executive session.

The Secretary then presented the quarterly report of the laboratory, from October 1st to December 31st, 1908, showing a total of 808 samples examined during that period.

A communication was presented from the mayor of Canal Dover requesting the Board to re-appoint Mr. H. H. Prince health officer of that city, at a salary of $15.00 per month. The power of the Board to make this appointment was invoked upon the grounds that council was unable to secure members to serve as a board of health. It was moved by Dr. Chapman and seconded by Dr. Palmer that Mr. H. H. Prince be re-appointed health officer of the city of Canal Dover, at a salary of $15.00 per month for a term of one year.

Those voting in the affirmative were: Drs. Stanton, Chapman, Warner, Crossland and Palmer.

In the negative, none.

A communication was presented from Mr. J. Humes, mayor of Huron, asking that the Board should give approval of an intake for the proposed new water supply east of the Government Pier, provided certain arrangements could be made by the railroad company for land and switching services.

On motion of Dr. Chapman, duly seconded, it was voted to refer this matter to the chief engineer for further investigation and report.

A petition was presented from Mr. Phillip Doerfer, of Middlefield, asking the Board to make an investigation of certain unsanitary conditions alleged to exist in that village. The Secretary stated that when the petition was presented it was with the understanding that he would be communicated with further relative to a favorable time for the investigation asked for.

The Secretary presented plans for a filtration plant for the village of Huron, as prepared by Mr. L. E. Chapin, consulting engineer. In view of the fact that the intake for the new water supply was still under consideration, it was voted to postpone action in regard to the filtration plant until after the report of the engineer.

Plans were presented for a sewage purification plant for the Auglaize County Infirmary near Wapakoneta, submitted by Messrs. Bradbury and Shute of Columbus, consulting engineers, on January 15th, 1909, and described in specifications accompanying said plans. It was moved by Dr. Chapman and seconded by Dr. Palmer that said plans for the said Auglaize County Infirmary be approved.

Those voting in the affirmative were: Drs. Stanton, Crossland, Chapman, Warner and Palmer.

In the negative, none.

The Secretary presented two bills which had been prepared and introduced in the Legislature, one amending the bill providing for county hospitals for tuberculosis; and the other making provision for public instruction in the cause and prevention of tuberculosis in the public schools and by means of lecturers to be employed by the Board.

The Secretary stated that it was the duty of the Board to adopt rules and regulations governing county hospitals for tuberculosis. He presented the following rules and regulations, including a blank for admission to the hospital:

RULES AND REGULATIONS OF THE OHIO STATE BOARD OF HEALTH GOVERNING THE FRANKLIN COUNTY HOSPITAL FOR TUBERCULOSIS.

1. Applicants for admission to the county hospital for tuberculosis shall make application in writing to the directors of the hospital upon blanks to be furnished by said directors. All applicants will be examined by the physician in charge of the hospital who shall satisfy himself that the applicant for admission has pulmonary tuberculosis. Upon his certificate the hospital directors may order the admission to the hospital of the applicant.

2. Any patient may be peremptorily discharged from the hospital by the superintendent of the infirmary for violation of any rules or regulations governing the hospital, for persistent disobedience of the physician or nurse, or for unbecoming conduct.

MEALS.

3. Meals will be served at the following hours:

Breakfast	7:30 A. M.
Dinner	11:30 A. M.
Supper	5:30 P. M.

HOURS FOR RISING AND RETIRING.

4. Patients will be called at 6:30 A. M., and must be ready for breakfast at 7:30 A. M.

All patients must be in bed by 9:00 P. M.

5. Each patient will be expected to be in the dining room promptly at meal time unless excused by the nurse, and to occupy permanently the seat assigned to him or her by the nurse.

6. Each patient shall carefully wash his hands and teeth just before each meal.

7. No patient shall expectorate while at table, and shall leave the dining room for such purpose. Coughing while at the table must be suppressed as much as possible.

CARE OF SPUTUM.

8. No patient shall expectorate any place except in the sputum cup given him for that purpose.

Paper napkins will be provided to be used as handkerchiefs. These must be put in paper sacks after use, and will be collected twice a day and burned.

Each patient will be held responsible for his own sputum cup, which must be cleaned daily under the supervision of the nurse.

EXERCISE.

9. Exercise, which is an important part of the treatment, will be strictly regulated by the nurse under the direction of the physician.

Patients with much fever will be kept in bed; others will be required to strictly obey orders for the amount of exercise prescribed for each day.

LIBERTY OF GROUNDS.

10. No patient will be allowed to enter any of the infirmary buildings, nor to walk in any part of the infirmary grounds forbidden by the superintendent.

Any patient who leaves the hospital for a day or night without permission of the nurse will not be allowed to re-enter.

BATHING.

11. Each patient will be required to take a full bath and change underclothing once a week.

Daily shower baths, as a part of the treatment, will be prescribed by the physician, and enforced by the nurse.

VISITORS.

12. Visitors will be admitted each day between the hours of 2 and 4 P. M. While at the hospital they must confrom to the restrictions imposed by the nurse as to length of stay etcetera.

PACKAGES.

13. All packages sent to patients will be opened by the nurse.

Patients will not be allowed to receive eatables, except fresh fruit; alcohol in any form, nor medicine from any one except from those in charge of the hospital.

PHYSICIANS AND NURSES INSTRUCTIONS.

14. In addition to the foregoing rules and regulations patients will be expected to cheerfully follow any directions or instructions given by the physicians or nurse.

Such rules, regulations and instructions are for the benefit of the patients, and should be carefully followed in order that the best results in treatment may be obtained.

APPLICATION FOR ADMISSION TO THE FRANKLIN COUNTY HOSPITAL FOR TUBERCULOSIS.

To the Directors of the Franklin County Hospital for Tuberculosis:

I hereby make application for admission to the Franklin County Hospital for Tuberculosis.

Name ....
Address .... Street, No. ....
Age ....
Sex ....
Length of residence in Franklin County ....years.
Legal residence ....
Name and address of attending physician.......................................
....

I hereby certify that I have examined the applicant named above and that I find such person to have pulmonary tuberculosis and to be a suitable person for admission to the county hospital for tuberculosis.

....M. D.
Physician to Franklin County
Hospital for Tuberculosis.

To the Superintendent of the Franklin County Hospital for Tuberculosis:

Having investigated the application of .... for admission to the Franklin County Hospital for Tuberculosis. we hereby approve the same and order .... admission to said hospital subject to the rules and regulations governing such institution.

....
....
....
Directors of the Franklin County
Hospital for Tuberculosis.

Received at the Hospital .... 19....

....
Superintendent.

It was moved by Dr. Warner and seconded by Dr. Chapman that the rules and blank as presented by the Secretary be adopted.

Those voting in the affirmative were Drs. Stanton, Crossland, Chapman, Warner and Palmer.

In the negative, none.

The Board then went into executive session.

The Board having under consideration the conditions in and about the village of Marysville, and the complaint of the pollution of the water supply of the city of Columbus by the sewage from said village, it was moved by Dr. Warner and seconded by Dr. Chapman that the following resolution to this complaint be adopted, namely:

WHEREAS, The village of Marysville, through its officials and representatives, at a public hearing held at the office of the State Board of Health on January 20th, 1909, did promise and agree to take all measures in their power to secure the introduction of a system of sewers with sewage purification works in the near future for the village of Marysville; therefore

Be it Resolved, That the State Board of Health does hereby grant to said village of Marysville two years from this date in which to install a system of sewers and sewage purification works satisfactory to this Board.

The call for yeas and nays upon the adoption of this resolution resulted as follows: Yeas, Drs. Stanton, Crossland, Palmer, Chapman and Warner. Nays, none.

The Board voted to postpone action against The Ohio Box-board Company until sufficient time had been given to install apparatus which it is believed will abate the nuisance complained of.

The Board having under consideration the complaint against the village of Elmore as regards the pollution of the Portage River by the sewage from said village, it was moved by Dr. Chapman and seconded by Dr. Warner that this matter be referred to the chief engineer for further investigation and report.

The motion was carried.

No action was taken in regard to the complaint against the Darke County Infirmary polluting Bridge Creek.

The Board having under consideration the conditions in and about the city of Cambridge as pertaining to the pollution of Wills Creek by sewage from said city, it was moved by Dr. Warner and seconded by Dr. Crossland that the following resolution in reference to this complaint be adopted, namely;

WHEREAS, The representatives of the city of Cambridge at a public hearing in reference to the complaint against the said city, held at the office of the State Board of Health on January 20th, 1909, presented satisfactory evidence to show that said city is unable financially to pay for the installation of sewage purification works to remove the cause of complaint and to install a new public water supply, and

WHEREAS, It was further shown by said representatives that the water supply of Cambridge is badly polluted and a menace to public health, and

WHEREAS, It appears that the city council has already made appropriations looking towards the installation of a new water supply, therefore,

Be it Resolved, That action in this complaint be postponed for one year, provided that the authorities of the city of Cambridge take the necessary measures to secure the introduction of a satisfactory public water supply without delay.

The call for yeas and nays upon the adoption of this motion resulted as follows: Yeas, Drs. Stanton, Chapman, Warner, Palmer and Crossland. Nays, none.

The Board then took up for consideration the amendment proposed to the bill to establish a deputy state health officer. It was voted to refer the section opposed by the committee from the State Homeopathic Medical Society to the Attorney General for his opinion as to its constitutionality.

The Chair appointed Dr. Chapman and Dr. Warner as members of this committee. The committee having waited upon the Attorney General reported that they had presented this section in question to him, and that he stated that he was of the opinion that this would be held unconstitutional on the grounds of class legislation.

Matters previously acted upon by mail were then taken up for confirmation. These were as follows:

It was moved by Dr. Chapman and seconded by Dr. Palmer to confirm the Board's action of November 2nd, 1908, approving plans for a storm water sewer in the village of Newtown, to be located north from Main Street near the center of the village through Battle Alley, and thence northward to Clear Creek as indicated on lithograph plan on file with the State Board of Health provided;

1st. That the village council first pass an ordinance forbidding the tapping of said drain for the purpose of admitting water-closet wastes, sink drainage, or household wastes of any kind, and file a certified copy of this ordinance with the State Board of Health.

2nd. That there be located at every point where street washings are to enter said drain, catch basins of a design satisfactory to the State Board of Health and so constructed as to retain a considerable portion of the solid material.

Those voting in the affirmative were: Drs. Stanton, Chapman, Warner, Palmer and Crossland.

In the negative, none.

It was moved by Dr. Palmer and seconded by Dr. Warner to confirm the Board's action of December 24th, 1908, approving plans for proposed sewage purification works for the village of Oxford, as shown on plans submitted by The Riggs and Sherman Company, consulting engineers, on December 10th, 1908, provided:

1st. That detailed plans showing the automatic controlling devices and dosing tank, be submitted to the State Board of Health for approval before the work is begun.

2nd. That samples of all filtering material be submitted to the State Board of Health for approval before such material is placed.

3rd. That the village purchase, as a site for sewage purification, an area of land of such size that the filters need not be less than 300 feet from the boundary of the property at any point.

4th. That detailed plans showing the screens, be submitted to the State Board of Health for approval.

5th. That the proposed grit chambers be omitted.

Those voting in the affirmative were: Drs. Stanton, Chapman, Warner, Palmer and Crossland.

In the negative, none.

It was moved by Dr. Warner and seconded by Dr. Chapman to confirm the Board's action of December 28th, 1908, approving a proposed water supply for the village of Girard, to be obtained from drilled wells located on the property of William Cross, Jr., provided:

1st. That an iron removal plant satisfactory to the State Board of Health be installed before the water is delivered to consumers.

2nd. That plans showing the complete water works system including the land owned or controlled for present or future wells, be submitted to and receive the approval of the State Board of Health.

Those voting in the affirmative were: Drs. Stanton, Chapman, Warner, Palmer and Crossland.

In the negative, none.

It was moved by Dr. Chapman and seconded by Dr. Palmer to confirm the Board's action of January 12th, 1909, approving a proposed additional water supply for Delaware, to be derived from a series of tubular wells bordering the Olentangy River, on property controlled by the water company and shown on blue prints on file with the State Board of Health, provided:

1st: That the intake between the Olentangy River and the infiltration gallery be removed altogether or that a manhole be constructed about the controlling valve so as to make it readily accessible.

2nd. That (in case the river intake is maintained) the valve controlling same be locked and the key placed in the custody of the health officer. That in event of a severe fire or other great emergency, the water works officials be permitted to break the lock, but that in every such case immediate notification must be made to the health officer.

3rd. That the privy belonging to the pumping station be reconstructed in such a manner that fecal matter cannot get on to or into the soil, and that it be maintained in a cleanly condition satisfactory to the health officer.

4th. That no building other than the pumping station, nor any source of possible pollution be permitted within 500 feet of any well.

5th. That the water company file with the State Board of Health as soon as same can be prepared, a set of plans showing the location of each of the new wells, the old dug well, the infiltration gallery, the direct intake, and the connections from each of these sources to the pumps.

Those voting in the affirmative were: Drs. Stanton, Chapman, Warner, Palmer and Crossland.

In the negative, none.

It was moved by Dr. Warner and seconded by Dr. Palmer to confirm the Board's action of November 2nd, 1908, adopting the following letter to Mr. C. Creston Floyd, clerk of council, Dayton, Ohio:

"Dear Sir: —

The State Board of Health, in compliance with a resolution of your city council, made an investigation of the conditions of the Great Miami River, as affected by the discharge into it of wastes from the Aetna Paper Company, on October 20th, 1908.

It was found that a considerable quantity of a colored liquid waste containing fine sediment was being discharged into the river by this company. The river, which was at a very low stage, was discolored for some distance below, but no especially disagreeable odor was noticeable. The process of manufacturing the paper was then fully examined.

The Board has concluded from this investigation that the discharge of wastes from the Aetna Paper Company, while objectionable from an aesthetic standpoint, has not caused a nuisance detrimental to health, nor one calling for the enforcement of the provisions of the so-called Bense Act."

Those voting in the affirmative were: Drs. Stanton, Chapman, Warner, Palmer and Crossland.

In the negative, none.

On motion it was voted to adjourn to the call of the president.

Attest: C. O. Probst,
Secretary.

APRIL MEETING.

A regular meeting of the State Board of Health was held at the office of the Secretary, Columbus, Ohio, on April 21st, 1909, at 8 P. M.

There were present Messrs. Stanton, Crossland, Warner, Palmer and Hartzell.

Dr. Chapman telegraphed that he was detained at home by illness.

The minutes of the last regular meeting were read and approved; also the quarterly report of the Secretary.

Mrs. Lillian Burt, of Columbus, secretary of the Woman's Christian Temperance Union, appeared before the Board with a request that it should publish a circular on the prevention of venereal diseases. She stated that they had an organization which would enable them to personally place such a circular in some 27,000 homes. The matter was referred to executive session.

The following delegates from New Philadelphia were introduced: R. T. Horning, member of city council; John Kaderly, member of the board of health; N. W. Senhauser, member of the board of trade; Fred Clauser, member of board of trade; W. A. Wagner, member of board of trade; and J. F. Kuhns, city solicitor. They addressed the Board in reference to sewerage conditions at that point. They asked that they be given permission to construct a new outlet sewer farther down the river without the introduction of purification works. The matter was referred to executive session.

Mr. I. S. Mackey from Apple Creek appeared before the Board in reference to receiving approval of plans for the use of a certain spring for a public water supply.

Mr. W. T. Evans, health officer of Barnesville, appeared before the Board to urge that permission be given under proper regulations to make use of the reservoir, which supplies Barnesville with water, for fishing purposes.

The village solicitor of Carthage, Mr. Bell, and two members of council appeared before the Board in reference to plans for a sewerage system for that village. As the plans had not been reported upon by the engineering department, no action was taken.

The Board then went into executive session.

On motion of Dr. Warner, seconded by Dr. Crossland, it was voted to instruct the Secretary to prepare an appropriate circular on the prevention of venereal diseases, and have printed 50,000 copies, for distribution to parents and adults by the Woman's Christian Temperance

Union, as proposed by Mrs. Burt, its secretary, and through other proper channels.

Those voting in the affirmative were Drs. Stanton, Crossland, Warner, Palmer and Hartzell.

In the negative, none.

The request to permit fishing in the reservoir supplying water to the village of Barnesville was taken up for consideration.

It was moved by Dr. Warner and seconded by Dr. Crossland that this request be not granted.

Those voting in the affirmative were: Messrs. Stanton, Crossland, Warner, Palmer and Hartzell.

In the negative, none.

The Board having under consideration conditions existing in and about the city of New Philadelphia as pertaining to the pollution of the Tuscarawas River by the discharge of sewage and other wastes into said river by the said city of New Philadelphia, and having before it the report of the committee heretofore appointed by this Board to investigate such conditions, the same was by motion of Dr. Crossland and seconded by Dr. Palmer ordered read. The report was then read.

It was then moved by Dr. Crossland and seconded by Dr. Palmer that the Board does find from the report of its committee and other evidence that the Tuscarawas River at and below the city of New Philadelphia is grossly polluted by the sewage and other wastes from the said city of New Philadelphia, and that the conditions thereby created are detrimental to the comfort of persons residing in its vicinity.

The roll call for yeas and nays upon the adoption of this motion resulted as follows: Yeas, Messrs. Stanton, Crossland, Warner, Hartzell and Palmer.

Nays, none.

Thereupon it was moved by Dr. Warner and seconded by Dr. Crossland that the Secretary of this Board notify the city of New Philadelphia of the findings made by this Board, and that the Board has fixed Wednesday, the 16th day of June, 1909, at 8:00 P. M. at the Secor Hotel in Toledo, Ohio, as the time and place when and where the city of New Philadelphia, by its officers, or others, may have an opportunity, if desired, to be heard, and to show cause, if any, why said city should not be required to purify, or make such other disposal of its sewage and other wastes as will remove the conditions complained of.

The roll call for yeas and nays upon the adoption of this motion resulted as follows: Yeas, Messrs. Stanton, Crossland, Warner, Hartzell and Palmer.

Nays, none.

The Board having under consideration the conditions existing in and about the city of Bucyrus as pertaining to the pollution of the Sandusky River by the discharge of sewage and other wastes into said river by the said city of Bucyrus, and having before it the report of the committee heretofore appointed by this Board to investigate such conditions, the same was by motion of Dr. Warner and seconded by Dr. Crossland ordered read.

The report was then read.

Said Board then upon consideration of the report of said committee and upon other evidence in connection therewith finds that the sewage and other wastes flowing from the city of Bucyrus into said stream, known as the Sandusky River, have so corrupted the same as to give rise to foul and noxious odors, detrimental to the comfort of persons residing in the vicinity of said stream, and said city of Bucyrus having been notified of the complaint heretofore filed with this Board, made after investigation thereof, appeared before the Board, and was represented by Mr. O. W. Kennedy, city solicitor, and Mr. F. L. Niederheiser, city engineer. An opportunity was then given to said city through and by its officers named to be heard regarding said complaint, who stated that conditions were as set forth in the committee's report of this Board, and that no good cause could be urged why the city of Bucyrus should not be required to properly purify its sewage in order to abate the nuisance complained of.

After such hearing it was moved by Dr. Warner and seconded by Dr. Crossland that the report of the committee of the Board be now approved and confirmed.

Upon the roll call for the yeas and nays upon the adoption of this motion, the same resulted as follows: Yeas, Messrs. Stanton, Crossland, Warner, Palmer and Hartzell.

Nays, none.

It was moved by Dr. Warner and seconded by Dr. Crossland that it is hereby declared to be necessary that the city of Bucyrus shall be required to purify its sewage in a manner satisfactory to the State Board of Health on or before October 1st, 1911.

Upon the roll call for the yeas and nays upon the adoption of this motion, the same resulted as follows: Yeas, Messrs. Stanton, Crossland, Warner, Palmer and Hartzell.

Nays, none.

Thereupon it was moved by Dr. Warner and seconded by Dr. Crossland that the report and findings of the Board be transmitted to the Governor and Attorney General for their action thereon.

Upon the roll call for yeas and nays upon the adoption of this motion, the same resulted as follows: Yeas, Messrs. Stanton, Crossland, Warner, Palmer and Hartzell.

Nays, none.

A recess was then taken to 8:30 A. M. of the following day.

SECOND SESSION.

The Board reconvened at 8:30 A. M., April 22nd, pursuant to adjournment, the same members being present as before.

On motion of Dr. Warner and seconded by Dr. Palmer, it was voted to send the Secretary to the fifth annual meeting of the National Association for the Study and Prevention of Tuberculosis, to be held in Washington, D. C., May 13th-15th, 1909.

A report by the engineer was presented on detailed plans for a new system of water works for the city of Portsmouth.

It was moved by Dr. Palmer and seconded by Mr. Hartzell that the detailed plans for the pumping plant and natural filtration system for Portsmouth, submitted by the board of public service, and prepared by Mr. Samuel M. Gray, of Providence, R. I., consulting engineer, be approved, provided:

That the plans for the covered reservoir, which is to store water for back flushing, be submitted to the State Board of Health for approval before the same is installed.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Palmer and Hartzell.

In the negative, none.

The Secretary was instructed to recommend to the board of public service, in order to facilitate back flushing and thus prolong the life of the system at Portsmouth, (a) that the strainer pipes be surrounded by coarse gravel; (b) that each strainer pipe consist of two portions, the portion nearer the main carrier being 6 inches in diameter and the outer portion 4½ inches; and (c) that the strainers be tapped into the main carrier on opposite sides on a "staggered" plan instead of arranging to have the two strainer pipes enter the carrier directly opposite each other.

It is understood that conditions Nos. 1 and 3, of the letter of approval of October 26th, 1908, are still in force.

A report by the engineer on the automatic controlling devices proposed for the sewage purification plant for Oxford was presented, the plans for such devices having been submitted by The Riggs and Sherman Company of Toledo, consulting engineers for this village.

It was moved by Mr. Hartzell and seconded by Dr. Palmer that the automatic controlling devices proposed for the sewage purification plant for Oxford, as shown on drawings submitted by The Riggs and Sherman Company of Toledo, consulting engineers, on April 19th, 1909, be approved.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Palmer and Hartzell.

In the negative, none.

The report of the committee, consisting of Dr. Warner and the chief engineer, upon the plans for proposed sewerage for the Fourth Ward of the city of Niles was submitted.

It was moved by Dr. Palmer and seconded by Mr. Hartzell that proposed sewerage for the Fourth Ward of the city of Niles, as shown on plans submitted to the Board by Mr. John S. Naylor, mayor, and Mr. F. M. Brewer, city engineer, January 20th, 1909, be disapproved.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Palmer and Hartzell.

In the negative, none.

A report was presented upon plans for proposed sewerage and sewage purification for the village of Louisville.

It was moved by Dr. Warner and seconded by Dr. Palmer that the plans for proposed sewerage and sewage purification for Louisville, as shown on drawings submitted April 7th, 1909, by Mr. F. E. Myers of Canton, consulting engineer for the village, be approved, provided:

1st. That the proposed plant be installed before any of the proposed sewers are placed in use.

2nd. That samples of all filtering material be submitted to and receive the approval of the State Board of Health before being placed.

3rd. That detailed plans of the pumping machinery and automatic controlling devices be submitted to and receive the approval of the State Board of Health before being installed.

4th. That this approval be void after May 1st, 1910, unless construction of the works is commenced before that date.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Palmer and Hartzell.

In the negative, none.

A report was presented on the new additional water supply for the city of Delaware to be obtained from a series of tubular wells in gravel deposits near the existing water works. These wells were approved by the Board under certain conditions, but a communication was received from the board of health of Delaware, stating that the water company had failed to comply with conditions 1 and 2 of such approval. These conditions provided in brief for locking the valve controlling the emergency intake to the Olentangy River, and depositing the key to the lock with the health officer of Delaware.

It was moved by Dr. Warner and seconded by Dr. Palmer that in lieu of conditions 1 and 2 of the Board's former approval of the new water supply as stated in a communication to the water works company under date of January 12th, 1909, that the following conditions be substituted, to-wit:

"Only the new additional supply shall be used under ordinary circumstances and when it becomes necessary to use any portion of the old supply, immediate notification thereof shall be made to the local health officer. In order that the public may be assured of the carrying out of this condition, the health officer shall be empowered to place locks or seals upon the valves admitting the old supply into the pumps; but the water company shall be permitted to break such locks or seals, provided notification is made to the health officer or his authorized representatives within a half hour after the same shall have been broken."

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Palmer and Hartzell.

In the negative, none.

Mr. Alexander Potter, of New York, who has been retained by the city of Warren to prepare plans for sewage purification, asked the Board to pass upon the question of permitting the city to use storm water overflows into the river.

The question being under discussion, it was moved by Dr. Warner and seconded by Mr. Hartzell that storm water overflows for the city of Warren be disapproved.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Palmer and Hartzell.

In the negative, none.

A report of the engineer was presented on proposed sewerage and sewage purification for Mt. Gilead.

It was moved by Dr. Palmer and seconded by Mr. Hartzell that the plans for sewerage and sewage purification for Mt. Gilead, as shown on drawings submitted April 6th, 1909, by Mr. W. B. Eells, village engineer, be approved, provided:

1st. That samples of all filtering material be submitted to and receive the approval of the State Board of Health before being placed.

2nd. That one-fourth acre of filtering area be constructed before any of the new sewers are placed in use, and that the entire works as shown on plans be completed within one year after the first installation is placed in use.

3rd. That this approval be void after May 1st, 1910, unless construction of the works is commenced before that date.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Palmer and Hartzell.

In the negative, none.

A report of the engineer was presented on proposed sewerage and sewage purification for the village of Marble Cliff, Franklin County.

It was moved by Mr. Hartzell and seconded by Dr. Palmer that plans for proposed sewerage and sewage purification for the village of Marble Cliff, Franklin County, as shown on drawings and as described in specifications submitted April 14th, 1909, by Messrs. Bradbury and Shute of Columbus, consulting engineers, be approved, provided:

1st. That samples of all filtering material be submitted to and receive the approval of the State Board of Health before being placed.

2nd. That detailed drawings of all automatic apparatus be submitted to and receive the approval of the State Board of Health before the same is installed.

3rd. That the sewage purification works be completed before any of the proposed new sewers are placed in use and that a competent person, satisfactory to the State Board of Health, be employed and held responsible by the village for the proper operation of the purification works.

4th. That this approval be void after May 1st, 1910, unless construction of the work is commenced before that date.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Palmer and Hartzell.

In the negative, none.

A report of the engineer was presented on proposed storm sewer system for the village of Linden Heights, Franklin County.

It was moved by Dr. Palmer and seconded by Mr. Hartzell that the plans for a proposed storm sewer system for the village of Linden Heights, Franklin County, as shown on drawings submitted by Messrs. Bradbury and Shute of Columbus, consulting engineers, on March 15th, 1909, be approved, provided:

1st. That the village council pass and file with the State Board of Health an ordinance forbidding the tapping of all sewers shown on plans submitted and any future sewers tributary thereto, for the purpose of admitting water-closet wastes, sink drainage, or household wastes of any kind.

2nd. That this approval be void after May 1st, 1910, unless construction of the sewers is commenced before that date.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Palmer and Hartzell.

In the negative, none.

A report of the engineer was presented on proposed sewage purification plant for Oberlin.

It was moved by Dr. Warner and seconded by Dr. Palmer that the plans for sewage purification plant for Oberlin, as shown on drawings submitted by the village engineer, Mr. W. F. Schickler, on April 13th, 1909, be approved, provided:

1st. That samples of all filtering material be submitted to and receive the approval of the State Board of Health before being placed.

2nd. That details of all automatic apparatus be submitted to and receive the approval of the State Board of Health before same is installed.

3rd. That this approval be void after May 1st, 1910, unless construction of the plant is commenced before that date.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Palmer and Hartzell.

In the negative, none.

Matters previously acted upon by mail were taken up for confirmation as follows:

On motion of Dr. Crossland and seconded by Dr. Warner, it was voted to confirm the Board's action of February 6th, 1909, approving plans for a proposed filtration plant for Huron, as shown on blue prints submitted by Mr. L. E. Chapin of Canton, consulting engineer, on January 15th, 1909, provided:

1st. That detailed plans of the distribution system of the water works be submitted to and receive the approval of the State Board of Health before being constructed.

2nd. That the 6-inch wash water pipe supplying the filters and also the manifold pipe or main collector be increased to at least 10 inches in diameter.

3rd. That the lines carrying the coagulated water from the sedimentation basin to the filters be enlarged and straightened so that a velocity therein, based on the nominal capacity of the plant, will not exceed 2 feet per second.

4th. That the clear well be increased in size or other storage be provided in the standpipe or elsewhere, so that the total storage for filtered water will be at least 200,000 gallons.

5th. That the raw water pump be installed in duplicate.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Palmer and Hartzell.

In the negative, none.

On motion of Dr. Warner and seconded by Mr. Hartzell it was voted to confirm the Board's action of February 6th, 1909, approving a proposed intake for Huron, to be located in Lake Erie at a point approximately 600 feet east from the end of the easterly breakwater and 100 feet within the outer end of said breakwater; provided that detailed drawings showing the exact location and method of construction of the intake, and detailed plans for the intake well, be submitted to and receive the approval of the State Board of Health before the work is begun.

It is understood that the action of the Board of December 10th, 1908, approving plans for the westerly location for the intake, is still valid, and that such westerly location may be used in case the village fails to make suitable arrangements with the railroad company for erecting the pumping station at the easterly location.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Palmer and Hartzell.

In the negative, none.

On motion of Mr. Hartzell and seconded by Dr. Palmer it was voted to confirm the Board's action of February 15th, 1909, approving a proposed water supply for Lewisburg, to be obtained from wells located on a lot about 1000 feet east of the easterly corporation limit and approximately one and one-fourth acres in area, on the southerly side of Clay Street just to the westward of its intersection with Dayton Street, provided:

1st. That if the water is found to deteriorate in quality, the supply be abandoned within one year after receipt of notice to that effect from the State Board of Health.

2nd. That the village secure control over sufficient land surrounding the wells to prevent the location of any buildings or other sources of possible contamination within a distance of at least 300 feet from the nearest well.

3rd. That the village council pass an ordinance prohibiting the existence within 500 feet of any public supply well, of pigpens, manure heaps, or deposits of refuse of any putrescible character whatsoever; and, further, that all privies located within 500 feet of any public supply well be constructed and maintained in accordance with the accompanying set of rules and regulations.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Palmer and Hartzell.

In the negative, none.

RULES FOR CONSTRUCTION AND MAINTENANCE OF PRIVIES.

1. All privies shall be provided with watertight receptacles resting at or above the surface of the ground and so placed that all fecal matter is discharged into them.

2. The receptacles in which fecal matter is contained shall be entirely enclosed in a suitable compartment under the seats, which will prevent the admission of flies but shall be so constructed as to be readily accessible for inspection and the removal of receptacles.

3. All seats shall be provided with hinged covers which will not remain open unless held open.

4. An ample supply of powdered slaked lime or dry loamy earth shall be accessible for sprinkling over the fecal matter after each use of the privy.

5. As soon as full, receptacles shall be emptied and the material removed at least one-fourth of a mile beyond the city limits and buried in the ground.

6. It shall be the duty of the health officer or his representatives

to inspect all privies not less frequently than once in two months, and to prosecute persons found not complying with the above rules.

On motion of Dr. Palmer and seconded by Dr. Crossland, it was voted to confirm the Board's action of March 1st, 1909, approving, for a proposed public water supply for St. Henry, the territory located at the northwest corner of Washington and Sycamore streets and including a plot of land 130 feet wide in a north and south direction and 150 feet long in an east and west direction, provided:

1st. That the quality of the water after test wells are driven and pumped, be satisfactory to the State Board of Health.

2nd. That if at any time the quality of the water, in the opinion of the State Board of Health, so deteriorates as to be a menace to the health of the water takers, the village shall agree to secure a new source of supply farther removed from possible sources of contamination.

3rd. That the approval be not considered in effect until the village council shall have passed an ordinance, first strictly forbidding the use of any abandoned well as a receptacle for disposing of any waste matters whatsoever; second, requiring all privies within 500 feet of any public supply well to be constructed in accordance with the accompanying set of rules and regulations; and third, requiring that all cesspools within 500 feet of any public supply well be made absolutely watertight: Further, that a certified copy of this ordinance be filed with the State Board of Health before the water works are placed in operation.

4th. That full detailed drawings and specifications showing the proposed method of developing the public supply and delivering same to consumers, be submitted to the State Board of Health before construction work is commenced.

5th. That this approval be valid only until January 1st, 1910.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Palmer and Hartzell.

In the negative, none.

Rules for Construction and Maintenance of Privies. (See page 38.)

On motion of Dr. Crossland and seconded by Dr. Warner it was voted to confirm the Board's action of March 1st, 1909, approving a proposed change in water supply of Akron by the method outlined in communication from Mr. L. M. Latta, general manager of The Akron Water Company, of December 7th, 1908, provided The Akron Water Company employs a competent water analyst, satisfactory to the State Board of Health, who shall make daily bacterial and chemical analyses of the raw and filtered water as well as the water delivered to consumers for a period of three months, such analyses to be regularly submitted to the State Board of Health.

After the proposed works have been operated and carefully studied as outlined above, the State Board of Health will take definite action in regard to permanently approving the system.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Palmer and Hartzell.

In the negative, none.

(After experiments with the system proposed it was voluntarily abandoned by The Akron Water Works Co.)

On motion of Dr. Warner and seconded by Mr. Hartzell it was voted to confirm the Board's action of March 2nd, 1909, approving detailed plans for development of the Swanton water supply and ordinance for protecting same, submitted February 2nd, 1909, by Mr. George Champe of Toledo, consulting engineer, in order to comply with conditions Nos. 2 and 4 of the Board's approval of the source of supply under date of September 24th, 1908.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Palmer and Hartzell.

In the negative, none.

The board of trustees of public affairs of Swanton were advised that it would be desirable to place a roof on the elevated tank for protection against contamination by birds; and suggested that additional fire protection may be obtained through the development of the deep seated water in well No. 1.

On motion of Mr. Hartzell and seconded by Dr. Palmer it was voted to confirm the Board's action of March 3rd, 1909, approving a proposed sewer for The Massillon Foundry and Machine Company, of Massillon, as requested in a communication from F. G. Harrison, secretary of the company, under date of January 20th, 1909, the sewer to discharge into the Tuscarawas River at a point on the north bank of the stream between North West Street and the tracks of the Pittsburg, Ft. Wayne and Chicago Railway, provided the company ceases to so dispose of its sewage as soon as it is practicable, in the opinion of the State Board of Health, to connect with the city sewerage system, or as soon as sewage purification works are built by the city.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Palmer and Hartzell.

In the negative, none.

On motion of Dr. Palmer and seconded by Dr. Crossland it was voted to confirm the Board's action of April 1st, 1909, approving a proposed improvement of the infiltration system of Ironton by "dredging and breaking up the hardpan outside the pure water well clusters in the Ohio River at Ironton, Ohio," as shown on plan and description submitted by Mr. C. H. Ketter, president of the board of public service, on March 24th, 1909, with the understanding that should the proposed improvement not result in securing a bacteriologically safe water, steps shall be immediately taken toward further improving the supply.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Palmer and Hartzell.

In the negative, none.

On motion of Dr. Crossland and seconded by Dr. Warner it was voted to confirm the Board's action of April 13th, 1909, approving a proposed location for intake for water supply for Put-in-Bay, on the southeasterly side of the island, as shown on a drawing submitted by Charles E. DeWitt of Port Clinton, consulting engineer for the village, on April 1st, 1909, provided:

1. That in case the quality of the water, after investigation by the State Board of Health, should not prove to be satisfactory the intake be extended further into the lake, or purification works be installed.

2. That full detailed plans showing the construction of the intake and the pumping station be submitted to and receive the approval of the State Board of Health before the same are constructed.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Palmer and Hartzell.

In the negative, none.

On motion of Dr. Warner and seconded by Dr. Crossland it was voted to confirm the Board's actions approving the following named persons for licenses to conduct maternity boarding houses and lying-in hospitals:

FEBRUARY 4th, 1909:
Mrs. James T. Black, 633 West Spring Street, Lima, Ohio.
Mrs. Mary E. Throp, Jason Avenue, Clinton Township, Franklin County.
Zella Briggaman, 591 Lehman Street, Columbus, Ohio.
Margaret Conklin, West Broadway, Clinton Township, Franklin County.
Dr. F. H. Darby, 34 West First Avenue, Columbus, Ohio.
Dr. Carrie Chase Davis, 826 Washington Avenue, Sandusky, Ohio.
Mrs. Nora Foster, 13 West Oakland Avenue, Columbus, Ohio.
Celia P. Fyler, 964 Highland Avenue, Columbus, Ohio.
St. Anna's Infant Asylum, Columbus, Ohio.
The Retreat Maternity Hospital and Foundling Home, Toledo, Ohio.
St. Anne's Infant Asylum and Maternity Hospital, Cleveland, Ohio.
FEBRUARY 26th, 1909:
Mrs. Annette S. Chase, 3119 Marvin Avenue, Cleveland, Ohio.
Cleveland Humane Society (Infants Rest), 9014 Cedar Avenue, Cleveland, Ohio.
Mrs. Emma Briggs, 6616 Faircourt Avenue, N. E., Cleveland, Ohio.
Mrs. Ida Dewey, 7804 Kinsman Road, Cleveland, Ohio.
Mrs. Amelia Eble, 4720 Ravine Avenue, Cleveland, Ohio.
Miss Minnie Knapp, 2413 West 11th Street, Cleveland, Ohio.
Mrs. Leah Martin, 5025 Deloff Road, Cleveland, Ohio.
Maternity Hospital of Cleveland, 2364 East 55th Street, Cleveland, Ohio.
Salvation Army Maternity Hospital and Nursery, 5905 Kinsman Road, Cleveland, Ohio.
Woodhill Private Hospital, 3152 East 93rd Street, Cleveland, Ohio.
MARCH 5th, 1909:
Mary Howard, 130 Clark Street, Cincinnati, Ohio.
APRIL 10th, 1909:
Mrs. Margaret Snyder, 276 West Woodruff Avenue, Columbus, Ohio.

Mr. and Mrs. R. Jewell, 308 East Town Street, Columbus, Ohio.
Mrs. Irene Jewell, 74 St. Louis Avenue, Youngstown, Ohio.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Palmer and Hartzell.

In the negative, none.

On motion of Mr. Hartzell and seconded by Dr. Warner it was voted to confirm the Board's actions disapproving the following named persons for licenses to conduct maternity boarding houses and lying-in hospitals:

February 8th, 1909:
    Mrs. Nola Pavy, 338 North Front Street, Hamilton, Ohio.
    Mrs. Marie Bretsch, 1610 Cherry Street, Toledo, Ohio.
    Dr. Elizabeth Francis, 817 West Seventh Street, Cincinnati, Ohio.
February 26th, 1909:
    Dr. C. Baker, 10405 Marlowe Avenue, Cleveland, Ohio.
April 10th, 1909:
    Mrs. Nora Cook, 236 East Spring Street, Columbus, Ohio.
    Mrs. M. Malott, 287 West Park Avenue, Columbus, Ohio.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Palmer and Hartzell.

In the negative, none.

On motion of Dr. Palmer, seconded by Dr. Crossland, it was voted to confirm the Board's actions approving health officers appointed by council to serve in lieu of a board of health.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Palmer and Hartzell.

In the negative, none.

Adjourned.

Attest: C. O. Probst,
Secretary.

JUNE MEETING.

A regular meeting of the State Board of Health was held at the Hotel Secor, Toledo, Ohio, June 16th, 1909, at 8 P. M.

Those present were: Messrs. Stanton, Crossland, Warner, Chapman, Hartzell and Palmer

Mr. Wm. McCoy appeared before the Board in regard to a proposed water supply for the villages of Roseville and Crooksville.

Mr. W. J. Sherman of Toledo, of The Riggs and Sherman Company, addressed the Board in regard to plans that had been submitted to the Board for the village of Delta.

Mr. Frank E. Holtcamp, clerk of the board of health, and the mayor of Elmore, appeared before the Board in regard to sewerage conditions in that village.

Mr. J. F. Kuhns, city solicitor of New Philadelphia, appeared before the Board as its representative in answer to a citation to meet the Board, and show cause, if any, why the city should not be required to install sewage purification works to abate a nuisance complained of under the Bense Act. Mr. Kuhns contended that the complaint formerly made by the board of health of New Philadelphia, under the Bense Act, was in effect a resolution and not a complaint. He filed a resolution by the board of health of said city, passed June 2nd, 1909, requesting the State Board of Health to dismiss the former resolution of the board of health of New Philadelphia from further consideration. He asked the Board for a modification of its former conditions of approval for additional sewers and a sewage disposal plant, such modification to be a requirement that but four filter beds be constructed in the first operation of the plant, additional filters to be added as required. He further requested that the Board should not require the building of a sewage disposal plant for a period of three or four years after their proposed changes and additions to their sewerage system.

These several matters were referred to executive session.

In executive session the question of disposal of the complaint against New Philadelphia under the Bense Act was first taken up for consideration.

It was moved by Dr. Chapman and seconded by Dr. Warner that further proceedings against New Philadelphia under the Bense Act be postponed; provided, (a) that the present sewer with an outlet into the Tuscarawas River near the foot of First Street be abandoned for house drainage or sewage; (b) that the city proceeds without further delay to install a system of sewers and sewage purification in accordance with plans submitted to the Board by Mr. Paul R. Murray of New Philadelphia, and Mr. E. G. Bradbury of Columbus, with permission, however, to construct in the beginning but four of the filter beds provided for the sewage disposal plant, and that such additional filters shall be constructed and placed in use as and whenever deemed necessary by the State Board of Health.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Chapman, Palmer and Hartzell.

In the negative, none.

Mr. W. G. Clark, engineer in charge of the water filtration plant being installed in Toledo, appeared before the Board, and invited the members to inspect the filtration plant on the following day.

On motion of Dr. Warner the invitation was accepted, and a vote of thanks extended to Mr. Clark.

The question of a new water supply for Delta was taken up for consideration.

It was moved by Dr. Warner and seconded by Dr. Chapman that the proposed water supply for the village of Delta, to be obtained from drilled wells located on a four-acre tract of land near the corporation line and just east of the valley of Bad Creek, as shown on plans submitted by The Riggs and Sherman Company of Toledo, Ohio, be approved on the following conditions:

1st. That before contracts are awarded a full set of detailed plans in duplicate be submitted to and receive the approval of the State Board of Health.

2nd. That unless construction is begun before July 1st, 1910, this approval be considered void.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Chapman, Hartzell and Palmer.

In the negative, none.

The question of a proper remedy for unsanitary conditions at Elmore arising from improper sewerage conditions was then taken up for consideration.

It was moved by Dr. Chapman and seconded by Dr. Warner (1) that the sewers known as the Cheapside Street Sewer, the Augusta Street sewer and the Fremont Street sewer, be condemned, and all connections with such sewers be ordered cut off until such time as a system of waterworks, or other adequate means of flushing said sewers, be provided; (2) that permission be given to construct a channel, as proposed by Elmore officials, in the bed of the Portage River to convey sewage below the village, and that the installation of a sewage purification plant be postponed until it could be ascertained whether this arrangement would sufficiently improve conditions complained of, and make such plant unnecessary at the present time.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Chapman, Hartzell and Palmer.

In the negative, none.

The question of a new water supply for the villages of Roseville and Crooksville was then presented.

It was moved by Dr. Warner and seconded by Dr. Palmer that the general scheme of obtaining a water supply for said villages as outlined by data submitted by A. W. Evans, trustee, on June 15th, 1909, said supply to be derived from wells to be located upon a fourteen-acre tract of land in the valley midway between the above two mentioned villages, be approved provided:

1st. That detailed plans showing accurately the boundaries of the water works property together with the location of the wells and details of development of the same be submitted to and receive the approval of the State Board of Health.

2nd. That iron be removed from the water unless further pumping tests show this to be, in the opinion of the State Board of Health, unnecessary.

3rd. That pumping tests show a sufficient quantity of water to be available.

4th. That this approval be valid only until July 1st, 1911.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Chapman, Hartzell and Palmer.

In the negative, none.

The minutes of the last meeting of the Board were then read and on motion of Dr. Warner were duly approved.

The Secretary presented his quarterly report which was also approved.

Plans for a proposed water supply for the village of Pleasant Hill were presented by the Secretary.

It was moved by Dr. Crossland and seconded by Dr. Chapman that the plans for a public water supply for Pleasant Hill, as submitted on June 2nd, 1909, by Dr. A. J. Bausman, member of the board of trustees of public affairs, and Mr. A. C. Reed, village engineer, said supply to be derived from wells located in the valley of the Stillwater River to the westward of the village, on a strip of land owned by the village, 150 feet wide and bordering the river bank, be approved provided:

1st. That before construction is begun, it be demonstrated by suitable pumping tests that the wells can yield a sufficient quantity of water to meet all demands.

2nd. That this approval be void after July 1st, 1910, if the water works have not been completed by that date.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Chapman, Hartzell and Palmer.

In the negative, none.

A report was submitted by the Secretary on plans for a new sewer for Youngstown, located in Poland Avenue, with two outlets into the Mahoning River, i. e., at Gibson Run and Hill Street.

It was moved by Dr. Chapman and seconded by Dr. Warner that the proposed sewer in Poland Avenue, Youngstown, as shown on plans submitted by F. M. Lillie, city engineer, on April 27th, 1909, be approved provided:

1st. That the city council first pass an ordinance providing for a general preliminary report on the problem of sewage purification for Youngstown with special reference to securing a suitable site for future sewage purification works.

2nd. That such report be submitted to the State Board of Health for its approval not later than January 1st, 1910.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Chapman, Hartzell and Palmer.

In the negative, none.

A report was presented by the Secretary on the pollution of Jennings Creek and the Auglaize River at and near the village of Delphos with special reference to Bense Act rulings of the Board and the disposal of acid pickling liquors from The Delphos Manufacturing Company's works. It was shown by said report that no satisfactory progress has been made for the abatement of a nuisance complained of under the Bense Act, the Board at a previous meeting having granted further time to the officials of Delphos upon the consideration of promises made by them for the abatement of said nuisance.

It was moved by Dr. Warner and seconded by Dr. Chapman, (1) that the council of the village of Delphos be notified that they would be expected to pass an ordinance directing The Delphos Manufacturing Company to remove its acid iron wastes from the village sewers on or before October 1st, 1909, or to install a satisfactory plant of its own for purifying its wastes before that date. (2) That the council be further notified that in case of failure on their part to pass and enforce such an ordinance as above mentioned further procedure will be taken by the State Board of Health under the Bense Act to compel the village of Delphos to construct a plant to purify all the sewage which is being discharged through the village sewers, including the acid iron wastes from The Delphos Manufacturing Company.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Chapman, Hartzell and Palmer.

In the negative, none.

The Secretary was instructed to inform the local officials of Delphos that if the acid iron wastes from The Delphos Manufacturing Company's plant are removed, or are first purified, the matter of the pollution of the Auglaize River by the city sewage apart from such acid iron wastes will then be investigated by the Board. He was further instructed to inform The Delphos Manufacturing Company that the State Board of Health would be glad to render it any assistance in its power in connection with the installation of a suitable plant for treating its waste liquors.

The Secretary presented a communication from Mr. Neil Starkey, clerk of the council of the city of Zanesville, requesting the State Board of Health to approve a new water supply for said city from a system of wells located upon lands along the banks of the Muskingum River, as shown upon plans accompanying said communication.

After some discussion, it was moved by Dr. Warner and seconded by Mr. Hartzell that the plans for a new water supply for the city of Zanesville, as shown upon drawings submitted by Mr. Neil Starkey, clerk of council of said city, be approved; that the council of Zanesville, however, be notified in the letter of approval that the Board is still of the opinion that although the proposed supply is satisfactory from a purely sanitary standpoint, the selection of the best public water supply, all things being considered, has not been made; and that the Secretary be instructed to present to the council the Board's reasons for entertaining this opinion. After some discussion of this motion it was moved by Dr. Crossland and seconded by Dr. Chapman to amend by referring to the Attorney General the question of determining the scope of the Board's authority in passing upon public water supplies and to secure his opinion as to whether the Board is limited to the consideration of purely sanitary matters in approving public water supplies submitted to it for approval.

The amendment being put to vote was carried. The original motion as amended was then voted upon and was carried.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Chapman, Hartzell and Palmer.

In the negative, none.

A recess was taken to 9 A. M. of the following day.

SECOND SESSION.

The Board reassembled at 9 A. M. Thursday, June 17, 1909.

Those present were Messrs. Stanton, Crossland, Warner, Chapman, Hartzell and Palmer.

A report on the work of the laboratory was presented.

The Secretary brought forward the question of asking the Legislature to authorize the State Board of Health to manufacture diphtheria antitoxin and anti-rabic material for free distribution.

On motion of Dr. Crossland, the Secretary was instructed to prepare a bill providing for this.

A report was presented on plans for the sewage pumping station and the construction of lateral sewerage for Jackson.

It was moved by Dr. Warner and seconded by Mr. Hartzell that approval be given for the construction of three miles of lateral sewers in Jackson, approved in 1901, and the pumping station shown on plans submitted on May 6th, 1909, provided:

1st. That plans for a sewage purification plant be submitted to the Board for approval not later than December 1st, 1909, and that construction of the sewage purification plant be begun not later than April 15th, 1910.

2nd. That records be kept of all taps into the sanitary sewers.

3rd. That the present connection to storm sewers be removed, and that further connections to same be strictly prohibited.

4th. That this approval be void after December 1st, 1909, unless construction of the pumping station and lateral sewers is commenced before that date.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Chapman, Hartzell and Palmer.

In the negative, none.

A report was presented on plans for a temporary additional water supply for the city of Dayton, to be obtained from a series of wells to be placed in the Miami River in the city of Dayton abutting city property just above the Steele dam.

It was moved by Dr. Crossland and seconded by Dr. Warner that approval be given to plans for a proposed temporary additional water supply for the city of Dayton, as requested in a communication from the board of public service of that city under date of May 6th, 1909, upon the following conditions:

1st. That in as much as the proposed additional supply is of a temporary character, this approval be considered void after July 1st, 1910, and that the proposed additional supply be permanently abandoned on that date unless reapproved by the State Board of Health.

2nd. That the proposed additional supply be used only in case the existing supply fails to yield a sufficient quantity of water for all the needs of the city.

3rd. That the city authorities take active steps to secure, as soon as possible, a permanent additional supply capable of meeting all demands, and to this end it is recommended that the plans of Mr. George H. Benzenberg be adopted.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Chapman, Hartzell and Palmer.

In the negative, none.

A report was submitted on plans for a sewerage system and sewage purification works for the village of Vermilion.

It was moved by Dr. Chapman and seconded by Mr. Hartzell that the plans for a system of sewerage and sewage purification for Vermilion, as submitted May 29th, 1909, by Messrs. Nichols and Muhlberg of Lorain, consulting engineers, be approved on the following conditions:

1st. That the screens be provided with vertically placed instead of horizontally placed bars, and be made readily accessible for cleaning and repair by dispensing with the concrete covering over them.

2nd. That careful records be maintained of the number and location of all house connections.

3rd. That this action of the Board be void after July 1st, 1910.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Chapman, Hartzell and Palmer.

In the negative, none.

A report was submitted on plans for a proposed water purification plant for the city of East Liverpool.

It was moved by Dr. Warner and seconded by Mr. Hartzell that the plans for the proposed mechanical filtration plant for the city of East Liverpool, as shown on drawings prepared by Messrs. John W. Hill and Sons, consulting engineers of Cincinnati, and submitted by Mr. W. L. Smith, member of the board of public service, June 7th, 1909, be approved provided:

1st. That a pressure regulator be installed to control the depth of water on the filters, unless the coagulating reservoir is lowered as recommended below.

2nd. That detailed plans of rate controlling devices for the filters and connections therewith be submitted to and receive the approval of the State Board of Health before being installed.

3rd. That loss of head gauges be provided for all the filters.

4th. That the wash water piping be lowered to the bottom of the filters whenever it is shown that the filters are not being washed satisfactorily, or when deemed necessary by the State Board of Health.

5th. That the main wash water pipe be continued to the center of each filter.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Chapman, Hartzell and Palmer.

In the negative, none.

The Secretary was instructed that the local officials of East Liverpool be informally advised as follows:

That the Board recommends, (1) that the coagulating reservoir should be lowered to such an elevation that it will not be necessary to pass the coagulated water through pressure regulating devices, and thus break up the "floc"; (2) that it is believed, with a well designed and properly operated mechanical system, sand washing devices, such as is proposed, will be unnecessary; and (3) that the Board fears that the design of the wash water system proposed, which is regarded as experimental, will not insure satisfactory washing of the filters; and that in changing the elevation of the wash water system after the filters have been in use (which may be done in accordance with above condition No. 4) the city would be put to an unnecessary expense.

The Secretary stated that he had presented to the Board for mail vote rules proposed by the authorities of the tuberculosis hospital at Warrensville (Cleveland) for governing this institution, but that a decisive vote had not been reached and he thought it advisable to present the question now, at this meeting.

After some discussion, it was voted on motion of Dr. Warner to take no action on these rules on the ground that the rules and regulations of the State Board of Health governing such institutions should be uniform, and that additional rules to govern local conditions could be made by local authorities.

A petition under the Bense Act was presented from the health officer of Collinwood, asking for an investigation of unsanitary conditions in Rockefeller Run.

This petition was referred to the engineer for preliminary investigation.

Dr. Warner brought up the question of the evil effects of high steps for getting on and off street cars, and suggested that a committee of one should be appointed to investigate this matter, and report a remedy if any could be found.

A motion to appoint such a committee was adopted. Dr. Stanton asked to be recorded as voting "No" on this proposition, as he did not believe this to be within the province of the Board.

Dr. Warner was appointed as a committee of one to investigate this matter, and report a remedy.

Dr. Warner also spoke on the danger of using gas stoves unprovided with a proper exhaust for the gases of combustion, and at his suggestion it was decided to issue a public warning to the people of the danger of using such stoves.

The Secretary presented a preliminary report on arrangements for carrying on the work of the disposal of city wastes.

Attention was called to the fact that the American Public Health Association would hold its annual meeting during the third week of October, and on motion of Dr. Chapman, it was voted to hold the October meeting of the State Board of Health on either the second or fourth Wednesday of that month.

On motion of Dr. Warner, the time and place of meeting were left to the President and also the preparation of a suitable program of the joint meeting of the State and local health authorities of southern Ohio.

Matters previously acted upon by mail were then taken up for confirmation as follows:

It was moved by Mr. Hartzell and seconded by Dr. Warner to confirm the action of the Board on April 28th, 1909, approving a tract of land of some eighty-three acres, adjoining and south of the infirmary grounds in Warren County, as a site for the location of a county hospital for tuberculosis.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Chapman, Hartzell and Palmer.

In the negative, none.

It was moved by Dr. Palmer and seconded by Mr. Hartzell to confirm the action of the Board on April 28th, 1909, approving a proposed public water supply for the village of Apple Creek, to be obtained from a flowing spring located about one-fourth mile from the center of Apple Creek on the property of W. Haley, provided:

1st. That all privies on the watershed above the spring be constructed and maintained according to the following rules and regulations:

(a) All privies shall be provided with watertight receptacles resting at or above the surface of the ground, the receptacles to be so placed and constructed that they may be readily inspected and removed.

(b) As soon as filled all receptacles shall be emptied and the material removed at least one-fourth mile beyond the village limits.

(c) It shall be the duty of the health officer, or his representative, to inspect all privies on the watershed above the spring not less frequently than once in two months, and to prosecute persons not complying with these rules.

2nd. That no privies be permitted within 200 feet of the spring, and that no cesspools of any character be constructed on the watershed above the spring.

3rd. That as soon as the village shall have provided itself with a system of sanitary sewers, all privies on the watershed shall be abandoned.

4th. That no animals be kept within 200 feet of the spring.

5th. That the flow of water from the spring be confined in a basin or reservoir the sides of which are watertight and extend at least 3 feet above the surrounding surface of the ground, and that the basin be covered to protect the water from contamination and to exclude the direct rays of the sun.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Chapman, Hartzell and Palmer.

In the negative, none.

It was moved by Dr. Warner and seconded by Dr. Palmer to confirm the action of the Board on May 7th, 1909, approving plans for proposed sewerage and sewage purification for Archbold, as shown on drawings submitted by Mr. George Champe of Toledo, consulting engineer, on April 22nd, 1909, provided:

1st. That detailed plans of the dosing apparatus be submitted to and receive the approval of the State Board of Health before the same is installed.

2nd. That samples of sand and crushed stone to be used in the intermittent sand filters be submitted to and receive the approval of the State Board of Health before being placed.

3rd. That this approval be considered void after June 1st, 1910, unless construction in accordance with plans submitted shall have been begun by that date.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Chapman, Hartzell and Palmer.

In the negative, none.

It was moved by Dr. Palmer and seconded by Dr. Crossland to confirm the action of the Board on May 20th, 1909, approving plans for a covered concrete reservoir of 2,000,000 gallons capacity, as shown on drawings submitted by Mr. Samuel M. Gray of Providence, R. I., consulting engineer, May 3rd, 1909, this reservoir being included in the plans for a proposed new water supply system for Portsmouth, which were approved by the State Board of Health on April 22nd, 1909.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Chapman, Hartzell and Palmer.

In the negative, none.

It was moved by Dr. Chapman and seconded by Dr. Palmer to confirm the action of the Board on May 24th, 1909, approving plans for proposed storm water sewers for Athens, submitted on May 19th, 1909, by the city solicitor and city engineer, provided:

1st. That the city council first pass and file with the State Board of Health an ordinance forbidding the tapping of all sewers shown on plans submitted and any future sewers tributary thereto, for the purpose of admitting water-closet wastes, sink drainage, or household wastes of any kind.

2nd. That this approval be void after June 1st, 1911, unless construction of the sewers is commenced before that date.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Chapman, Hartzell and Palmer.

In the negative, none.

It was moved by Dr. Crossland and seconded by Mr. Hartzell to confirm the action of the Board on June 7th, 1909, approving plans for proposed sewerage for Covington, provided:

1st. That sewage purification works of a design satisfactory to the State Board of Health be installed and placed in operation at the end of a period of three years from date of approval.

2nd. That the main sewer be of such a grade that it can be easily continued to a proper site for sewage purification works in the future.

3rd. That suitable manholes be installed at all changes of grade and direction, and that in no case shall there be a greater distance than 400 feet between manholes.

4th. That this approval be void after June 1st, 1911, unless construction of the sewers is commenced before that date.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Chapman, Hartzell and Palmer.

In the negative, none.

It was moved by Mr. Hartzell and seconded by Dr. Warner to confirm the action of the Board on June 7th, 1909, approving plans for proposed sewer for Middletown, as shown on plans submitted April 3rd, 1909, by Mr. W. E. McElree, city engineer, provided:

1st. That the outlet be carried downstream to a point just below the discharge of the turbines of the Oglesbee Paper Company and the Paul A. Sorg Paper Company's mills.

2nd. That the tops of all manholes be carried above the level of high water.

3rd. That an intercepting sewer be built and purification works be installed whenever in the opinion of the State Board of Health such works become necessary.

4th. That this approval be void after June 1st, 1911, unless construction of the sewer is commenced before that date.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Chapman, Hartzell and Palmer.

In the negative, none.

It was moved by Dr. Warner and seconded by Dr. Palmer to confirm the action of the Board on June 7th, 1909, approving the application of The Florence Crittenton Home, 1166 East Main Street, Columbus, Ohio, to conduct a maternity boarding house and lying-in hospital.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Chapman, Hartzell and Palmer.

In the negative, none.

It was moved by Dr. Palmer and seconded by Dr. Chapman to confirm the action of the Board on June 7th, 1909, disapproving the application of Fredericka Brachat, 4739 Ravine Street, Cleveland, Ohio, to conduct a maternity boarding house and lying-in hospital.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Chapman, Hartzell and Palmer.

In the negative, none.

It was moved by Dr. Crossland and seconded by Mr. Hartzell to confirm the Board's actions approving health officers appointed by council to serve in lieu of a board of health.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Chapman, Hartzell and Palmer.

In the negative, none.

The Board then adjourned to the call of the President.

Attest: C. O. Probst,
Secretary.

AUGUST, SPECIAL MEETING.

A special meeting of the State Board of Health was held in the city of Warren, Ohio, on August 5th, 1909, at 2 o'clock P. M. at the city hall. Representatives of the various cities and villages located upon the Mahoning River were present to consider the conditions of this river as regards furnishing a source of public water supply and for the disposition of sewage. Some seventy delegates were present and these questions were fully discussed.

SECOND SESSION.

At 7:30 o'clock P. M. the Board reassembled at the Park Hotel in Warren, to consider other business to come before it.

There were present Messrs. Stanton, Warner, Palmer and Hartzell.

The Board having under consideration the complaint that the city of Niles is discharging sewage and other wastes into the Mahoning River, so corrupting said river as to give rise to noxious and foul odors, thereby creating conditions detrimental to the health and comfort of the citizens of said city who reside in the vicinity of said river, and having before it the report of the committee appointed by this Board to investigate such conditions, the same was by motion of Dr. Warner, seconded by Dr. Palmer, ordered read. The report was then read.

It was moved by Dr. Warner and seconded by Dr. Palmer that the report of the committee and its findings be adopted.

Those voting in the affirmative were Messrs. Stanton, Warner, Palmer and Hartzell. In the negative, none.

A supplementary report upon conditions at Niles was then presented, in reference to the pollution of Mosquito Creek within corporation limits of the city of Niles by the discharge of sewage into said creek. This report showed Mosquito Creek to be polluted so as to cause a public nuisance, amenable, in all probability, under the Bense Act.

On motion of Dr. Warner, duly seconded, it was voted to notify the council of the city of Niles of the Board's findings in reference to the pollution of the Mahoning River and to inform them that an amended petition, setting forth the conditions in Mosquito Creek, would be considered by the Board.

The Board then took up for consideration the question of the pollution of the public water supply of the city of Niles, and having before it a report of the committee heretofore appointed by this Board to investigate such alleged pollution, the same was, by motion of Dr. Palmer, seconded by Dr. Warner, ordered read. The report was read.

It was then moved by Dr. Palmer and seconded by Dr. Warner that the Board does find, from the report of its committee and other evidence, that there is hardly sufficient water available at Niles to meet ordinary demands and that it is frequently necessary to supplement the supply by taking unfiltered water from the Mahoning River, and that this practice contaminates the entire supply and thus becomes a distinct menace to the citizens of Niles as has been shown by the prevalence of typhoid fever and other intestinal diseases in said city.

The roll call for yeas and nays upon the adoption of this motion resulted as follows: Yeas, Messrs. Stanton, Warner, Palmer and Hartzell. Nays, none.

Thereupon it was moved by Dr. Warner and seconded by Dr. Palmer, that the Secretary of the Board notify the city of Niles of its findings and that the Board has fixed Wednesday, the thirteenth day of October, 1909, at 8 P. M., at the St. Nicholas Hotel in Cincinnati, Ohio, as the time and place when and where the city of Niles, by its officers or others, may have an opportunity, if desired, to be heard and to show cause, if any, why said city should not be required to make such changes and additions to its water supply as will remove the conditions complained of.

The roll call for yeas and nays upon the adoption of this motion resulted as follows: Yeas, Messrs. Stanton, Warner, Palmer and Hartzell. Nays, none.

The Board having under consideration the conditions in and about the village of Collinwood as pertaining to the pollution of Rockefeller Creek, otherwise known as Lake Shore Ditch, by the discharge of sewage and other wastes into said creek, or ditch, by the said village of Collinwood, and having before it the report of the committee heretofore appointed by this Board to investigate such conditions, the same was, by motion of Dr. Warner, seconded by Mr. Hartzell, ordered read. The report was read.

It was moved by Mr. Hartzell and seconded by Dr. Palmer that the Board does find upon the report of its committee and other evidence that Rockefeller Creek, otherwise known as Lake Shore Ditch, is grossly polluted by sewage and other wastes from the said village of Collinwood, and that the conditions thereby created are detrimental to the comfort of persons residing in the vicinity of or passing by said Rockefeller Creek.

The roll call for the yeas and nays upon the adoption of this motion resulted as follows: Yeas, Messrs. Stanton, Warner, Palmer, and Hartzell. Nays, none.

Thereupon it was moved by Mr. Hartzell and seconded by Dr. Warner that the Secretary of this Board notify the mayor and council and the board of trustees of public affairs of the village of Collinwood of the findings made by this Board and that the Board has fixed Wednesday, the thirteenth day of October, 1909, at 8 P. M., at the St. Nicholas Hotel in Cincinnati, Ohio, as the time and place when and where the village of Collinwood, by its officers, or others, may have an opportunity to be heard, and to show cause, if any, why said village should not be required to make such change in the disposal of its sewage as will remove the conditions complained of.

The roll call for yeas and nays upon the adoption of this motion resulted as follows: Yeas, Messrs. Stanton, Warner, Palmer and Hartzell.

Nays, none.

The Board then took up for consideration plans and specifications for a sewage purification plant for the city of Alliance, submitted by Messrs. Bradbury and Shute, consulting engineers, on July 8th, 1909.

On motion of Dr. Warner, seconded by Mr. Hartzell, these plans were approved upon the following conditions:

1st. That fine screenings from locomotive cinders be not used as a filtering material in the fine grain filters, unless its suitability for such purpose is demonstrated to the satisfaction of the State Board of Health on an experimental scale;

2nd. That before January 1st, 1911, the city cause a thorough investigation to be made of the feasibility of reducing the abnormally high sewage flow with a view to extending the life of the purification works as at present designed, and that such investigation treat upon three points as follows:

a. The reduction of the abnormally high per capita water consumption by the installation of meters on service connections, or otherwise.

b. Measurements of sewage flow for detecting leakage of ground water with a view of renewing portions of sewers in especially bad repair.

c The reduction of storm water flow by the disconnection of down spouts and all subsurface drains.

3rd. That when the work outlined in the preceding condition is completed a full detailed report thereon be submitted to the State Board of Health; and

4th. That a shelter house be provided at the site of the purification works which will offer suitable shelter in all weather for a caretaker, serve as a store house for tools and implements that may be required for the upkeep of the plant and furnish a convenient place for conducting simple laboratory work which might be required in the daily control of the plant and for making special tests.

Those voting in the affirmative were Messrs. Stanton, Warner, Palmer and Hartzell.

In the negative, none.

In addition to these conditions of approval the suggestion was made that water from the public water supply be made available at the site of the purification works for sprinkling, for flushing, and for use in connection with tests on the efficiency of operation.

A communication was presented from Mr. J. G. Esselbaugh, health officer of Perry Township, Wood County, complaining that no changes or improvements had been made by the city of Fostoria in the management of its sewage disposal plant and that the nuisance formerly complained of on account of this, still existed.

On motion of Mr. Hartzell, it was voted to refer this complaint to the committee formerly appointed to investigate the conditions of the Fostoria sewage disposal plant for investigation and report.

Plans were presented for a sewer in Water Street, West Milton, approval of which request was made in a communication received June 16th, 1909, from Mr. Walter S. Kessler, village attorney.

It was moved by Dr. Palmer, seconded by Mr. Hartzell, that this sewer be approved provided:

1st. That the outlet of the sewer be extended well into the channel of the stream by means of a securely placed iron pipe;

2nd. That when in the opinion of the State Board of Health such a course becomes necessary, the village build the intercepting sewer already approved by the State Board of Health, together with sewage purification works;

3rd. That this approval be considered void unless construction of the proposed sewer shall have been begun before September 1st, 1910.

Those voting in the affirmative were Messrs. Stanton, Warner, Palmer and Hartzell.

In the negative, none.

There being no further business the Board adjourned.

Attest: C. O. Probst,
Secretary.

OCTOBER MEETING.

A regular meeting of the State Board of Health was held at the St. Nicholas Hotel, Cincinnati, at 8 o'clock P. M., on October 13th, 1909.

There were present Messrs. Stanton, Crossland, Warner, Palmer, Chapman, Miller and Hartzell.

Mr. E. J. Heckle of Cincinnati, consulting engineer for the village of Elmwood Place, appeared before the Board in regard to the approval of plans for sewerage and sewage purification for that village, and asked that the conditions of approval be removed upon his agreement to comply with such conditions.

The question of the site for the purification works being raised, this was on motion referred to Dr. Stanton for investigation.

It was then moved by Dr. Warner and seconded by Dr. Chapman that the plans for sewerage and sewage purification for the village of Elmwood Place, as submitted by Mr. E. J. Heckle, consulting engineer, be approved provided that plans with changes as agreed to by the engineer, Mr. Heckle, are filed with the State Board of Health, and provided further that the site for the purification works proposed meet with the approval of the special committee, Dr. Stanton, appointed to investigate the same.

(The site approved by Dr. Stanton is on the west side of Mill Creek, opposite Elmwood Place, at least 700 feet from the nearest house and over 500 feet from the Cincinnati, Hamilton and Dayton Railroad).

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Palmer, Chapman, Miller and Hartzell.

In the negative, none.

The city solicitor, clerk of council, and a member of the board of public service of the city of Greenville, appeared before the Board in response to a notice from the Secretary that they would be given an opportunity to show cause why proceedings should not be taken against the authorities of Greenville for failing to comply with the order of the State Board of Health for the introduction of sewage purification works. The city solicitor stated that council had tried to comply with the order and had engaged an engineer to prepare plans for such purification works, and that a question had been raised as to the authority of council to take this action, it being held by some that this authority is lodged with the board of public service. He asked that an extension of time be granted in which to determine the question of jurisdiction.

On motion of Dr. Warner, duly seconded, it was voted to stay any further action in this case for a period of thirty days, during which time the authorities of Greenville would submit to the Attorney General the question of jurisdiction in the case.

The Secretary stated that on September 8th, 1909, notice had been sent to the authorities of Niles, and that a representative was present.

The president then called for the representative from Niles and Mr. Joe Smith, city solicitor, appeared before the Board as the representative from said city and stated that he knew of no reason why the city of Niles should not be required to make such changes and additions to its water supply as will remove the conditions complained of under the Bense Act.

Upon such hearing being given, said officer filing no evidence, protest or remonstrance against the action or findings heretofore made, it was moved by Dr. Palmer and seconded by Mr. Hartzell that the report and recommendations therein contained be now approved and confirmed.

Upon the call for the yeas and nays upon the adoption of this motion the same resulted as follows: Yeas, Drs. Stanton, Warner, Chapman, Palmer, Crossland, Miller and Mr. Hartzell.

Nays, none.

It was thereupon moved by Dr. Palmer and seconded by Mr. Hartzell that it is hereby declared to be necessary that the city of Niles shall be required to make the changes and additions recommended in said report on or before October 13th, 1910.

Upon the adoption of this motion the yeas and nays were as follows: Yeas, Drs. Stanton, Crossland, Warner, Palmer, Chapman, Miller and Mr. Hartzell.

Nays, none.

Thereupon it was moved by Dr. Palmer and seconded by Mr. Hartzell that the report and findings of the Board be transmitted to the Governor and the Attorney General for their action thereon.

The yeas and nays upon the adoption of this motion were as follows: Yeas, Drs. Stanton, Crossland, Warner, Palmer, Chapman, Miller and Mr. Hartzell.

Nays, none.

The Board then took up for consideration the conditions existing in and about the city of Niles as pertaining to the pollution of Mosquito Creek by the discharge of sewage and other waste by the city of Niles into said creek, and having before it the report of the committee heretofore appointed by this Board to investigate such conditions the same was on motion of Dr. Warner and seconded by Dr. Palmer ordered read. The report was then read.

The Secretary then presented the following amended petition received from the city of Niles in regard to the pollution of Mosquito Creek.

A RESOLUTION.

A Resolution making complaint to the State Board of Health that the city of Niles is emptying sewage and other waste into Mosquito Creek.

SECTION 1. Be it resolved by the council of the city of Niles, State of Ohio, that the city of Niles, located in Trumbull County, Ohio, is discharging and permitting to be discharged, sewage and other waste into Mosquito Creek, and that the sewage and other waste discharged into said creek has so corrupted said creek as to give rise to foul and noxious odors, thereby creating conditions that are detrimental to the health and comfort of the citizens of Niles, Trumbull County, Ohio, who reside in the vicinity of said creek.

SECTION 2. The State Board of Health is hereby respectfully requested to investigate the conditions complained of, and to require the said city of Niles to install such works or means for purifying or otherwise disposing of its sewage and other wastes as may be determined by said Board, in accordance with "An Act to authorize the state board of health to require the purification of sewage and public water supplies and to protect streams against pollution", passed April 7, 1908.

Passed in council this 18th day of September, 1909.

(Signed) J. E. THOMAS,
President of Council.

Attest: (Signed) B. L. HOGAN,
Clerk.

Approved by me this 20th day of September, 1909.

(Signed) JOHN S. NAYLOR,
Mayor of city of Niles, Ohio.

The Board having before it the report of the committee heretofore appointed by this Board to investigate such conditions, upon consideration of said report and upon other evidence in connection therewith, and after investigation of the conditions in and about the city of Niles, finds that the sewage and other wastes flowing from the city of Niles into said stream, known as Mosquito Creek, have so corrupted the same as to give rise to foul and noxious odors and to conditions detrimental to the comfort of those residing in the vicinity of said stream. And the city of Niles, having been notified of the complaint heretofore filed with the Board and of its findings made after investigation thereof, appeared before the Board and was represented by Mr. Joe Smith, city solicitor, and an opportunity was then given to said city of Niles through its officer, to be heard regarding said complaint, and discussion both by the members of the Board and the officer representing said city regarding said conditions was had.

Upon such hearing being given, said officer filed no evidence, protest or remonstrance against the action or findings heretofore made. After such hearing it was moved by Dr. Warner and seconded by Dr. Palmer that the report of the committee be approved and confirmed.

Upon the call for the yeas and nays upon the adoption of this motion, the same resulted as follows: Yeas, Drs. Stanton, Crossland, Warner, Palmer, Chapman, Miller and Mr. Hartzell.

Nays, none.

It was thereupon moved by Dr. Chapman and seconded by Dr. Miller that improvements and changes are hereby declared to be necessary, and that the city of Niles should be required to provide adequate means for the disposal of its sewage on or before October 13th, 1910.

The roll call for yeas and nays upon the adoption of this motion resulted as follows: Yeas, Drs. Stanton, Crossland, Warner, Palmer, Chapman, Miller and Mr. Hartzell.

Nays, none.

Thereupon it was moved by Dr. Palmer and seconded by Mr. Hartzell that the findings of the Board be transmitted to the Governor and the Attorney General for their action thereon.

Upon the adoption of this motion the yeas were Drs. Stanton. Crossland, Warner, Palmer, Chapman, Miller and Mr. Hartzell.

Nays, none.

The Secretary stated that in response to the notice citing the authorities of Collinwood to appear before the Board he had received from the village clerk, Mr. J. F. Murray, a communication stating that council, by an official act on September 30th, 1909, waived its right of a hearing.

It was then moved by Dr. Chapman and seconded by Dr. Crossland, an opportunity having been given the village of Collinwood to be heard and the village filing no evidence, protest or remonstrance against the action or findings heretofore made, that the report and the recommendations therein contained be now approved and confirmed.

The roll call for the yeas and nays upon the adoption of this motion resulted as follows: Yeas, Drs. Stanton, Crossland, Warner, Palmer, Chapman, Miller and Mr. Hartzell.

Nays, none.

It was thereupon moved by Dr. Chapman and seconded by Dr. Crossland that the improvements and changes recommended in said report be, and the same are hereby declared to be necessary and that the same should be made on or before August 1st, 1910.

Upon the adoption of this motion the yeas were Drs. Stanton, Crossland, Warner, Palmer, Chapman, Miller and Mr. Hartzell.

Nays, none.

Thereupon it was moved by Dr. Crossland and seconded by Dr. Stanton that the report and its findings be transmitted to the Governor and the Attorney General for their action thereon.

Upon the adoption of this motion the yeas were Drs. Stanton. Crossland, Palmer, Chapman. Warner, Miller and Mr. Hartzell.

Nays, none.

The minutes of the regular meeting held June 16th and 17th, 1909, and of the special meeting held August 5th, 1909, were then read and on motion approved.

The election of officers for the ensuing year was then taken up.

Dr. Warner nominated Dr. J. C. Crossland of Zanesville as president for the ensuing year. The motion was seconded by Dr. Palmer.

The Secretary was instructed to cast the ballot of the Board for Dr. Crossland as president. The Secretary announced that he had cast the ballot, as directed, and Dr. Crossland was declared elected president.

Dr. Warner nominated Dr. Wm. T. Miller of Cleveland as vice-president and moved that the Secretary be directed to cast the ballot for Dr. Miller. The motion was seconded by Dr. Palmer and carried.

The Secretary announced that he had cast the ballot of the Board, as directed, and Dr. Miller was declared elected vice-president.

The Board then took up for consideration the conditions in and about the city of Fostoria as pertaining to the pollution of Portage Creek by the discharge of sewage and other wastes into said creek by the city of Fostoria, and having before it the report of the committee heretofore appointed by this Board to investigate such conditions, the same was, by motion of Dr. Miller and seconded by Dr. Stanton, ordered read. The report was then read.

It was then moved by Dr. Chapman and seconded by Dr. Warner that the report of the committee be adopted and that, from the report of its committee and other evidence in connection therewith, and after investigation of the conditions in and about the city of Fostoria, the Board does find that the sewage and other wastes flowing from the said city into said stream, known as Portage Creek, have so corrupted the same as to give rise to foul and noxious odors, and to conditions detrimental to the comfort of those residing in the vicinity of said stream.

The call for the yeas and nays upon the adoption of this motion resulted as follows: Yeas, Drs. Stanton, Crossland, Warner, Palmer, Chapman, Miller and Mr. Hartzell.

Nays, none.

Thereupon it was moved by Dr. Miller and seconded by Dr. Stanton that the Secretary of this Board notify the mayor and council and the board of public service of the city of Fostoria of the findings made by this Board and that Wednesday, the nineteenth day of January, 1910, at the office of the Secretary in Columbus, at 8:30 P. M., had been fixed as the time and place when and where they would be given an opportunity to be heard and to show cause, if any, why the Board should not require the city of Fostoria to enlarge and remodel existing sewage purification works in a manner satisfactory to the State Board of Health on or before August 1st, 1910.

The yeas and nays upon the adoption of this motion were Yeas, Drs. Stanton, Crossland, Warner, Palmer, Chapman, Miller and Mr. Hartzell.

Nays, none.

The Board then took up for consideration the complaint in regard to the pollution of streams and ditches flowing through Pulaski Township, Williams County, by the sewage and other wastes from the village of Bryan, and having before it the report of the committee appointed by this Board to investigate such conditions, the same was, on motion of Dr. Miller and seconded by Dr. Chapman ordered read. The report was then read.

It was moved by Dr. Chapman and seconded by Dr. Warner that the report of the committee be adopted and that from the report of its committee and other evidence in connection therewith, and after investigation of the conditions complained of, the Board does find that the sewage and other wastes from the village of Bryan flowing through the streams and ditches in Pulaski Township, Williams County, have so corrupted the same as to give rise to foul and noxious odors and to conditions detrimental to the health and comfort of those residing in the vicinity of said streams and ditches.

The roll call for the yeas and nays upon the adoption of this motion resulted as follows: Yeas, Drs. Stanton, Crossland, Warner, Palmer, Chapman, Miller and Mr. Hartzell.

Nays, none.

Thereupon it was moved by Dr. Chapman and seconded by Dr. Palmer that the Secretary notify the mayor and council and The Van Camp Packing Company of the findings made by this Board and that he send to the council a copy of the report, recommending that council employ the services of a competent consulting engineer and submit plans and estimates to the State Board of Health for approval not later than May 1st, 1910, to serve as a basis for further action by said Board. Also that The Van Camp Packing Company be notified that the Board will require said company, under the provisions of the Bense Act, to install a plant for the purification of its wastes, satisfactory to the State Board of Health, by October 1st, 1910.

The yeas and nays on the adoption of this motion were: Yeas, Drs. Stanton, Crossland, Palmer, Warner, Chapman, Miller and Mr. Hartzell.

Nays, none.

The Secretary was also instructed to inform said company that the Board will be glad to render assistance in the way of furnishing such general information in regard to the character of wastes, methods of treatment, etc., as will enable the company to properly design and construct a satisfactory purification plant.

The Board then adjourned to 9 A. M. of the following day.

SECOND SESSION.

The Board reassembled at 9 A. M. on the 14th day of October, all members being present.

The Board having under consideration the conditions in and about the city of Dayton as pertaining to the pollution of the water supply of said city by the wastes from the plants of The Wuichet Fertilizer Company and The Dayton Reduction Company, and having before it the report of the committee heretofore appointed by this Board to investigate such conditions, the same was by motion of Dr. Palmer and seconded by Dr. Warner ordered read. The report was then read.

It was moved by Dr. Palmer and seconded by Dr. Warner that the report of the committee be adopted and, upon consideration of the report and upon other evidence connected therewith, that the Board does find that while the discharge of wastes from the plants of The Wuichet Fertilizer Company and The Dayton Reduction Company may be objectionable for other reasons, there is not sufficient evidence to warrant the State Board of Health in ordering the above mentioned companies to cease the discharge of such wastes into Mad River on the ground that the public water supply of Dayton is affected thereby; that the Secretary be instructed to send a copy of the report to the board of health of Dayton, stating that the same had been approved and adopted by the State Board of Health.

The yeas and nays on the adoption of this motion were: Yeas, Drs. Stanton, Crossland, Warner, Palmer, Chapman, Miller and Mr. Hartzell.

Nays, none.

A communication was read from the city solicitor of New Philadelphia, Mr. J. F. Kuhns, in regard to permitting a change in site for the proposed sewage disposal plant.

The matter was referred to the engineer for investigation.

The Board then took up for consideration the question of the pollution of the public water supply of Akron, and having before it the report of the committee heretofore appointed by this Board to investigate such alleged pollution, the same was, by motion of Dr. Warner and seconded by Dr. Miller ordered read. The report was then read.

It was then moved by Dr. Warner and seconded by Dr. Miller that the Board does find, upon consideration of the report of its committee and upon other evidence connected therewith, that the public water supply of Akron is polluted and thereby dangerous to health.

The roll call for the yeas and nays upon the adoption of this motion resulted as follows: Yeas, Drs. Stanton, Crossland, Warner, Palmer, Chapman, Miller and Mr. Hartzell.

Nays, none.

Thereupon it was moved by Dr. Miller and seconded by Dr. Palmer that the Secretary of the Board notify the city of Akron and the owners of the water works, (The Akron Water Works Company), of the Board's findings and that the Board has fixed Wednesday, the nineteenth day of January, 1910, at 8 o'clock P. M., in the office of the Secretary in Columbus, as the time and place when and where the officials of the city of Akron and the owners of the water works may have an opportunity to be heard and to show cause, if any, why the city or The Akron

Water Works Company should not be required to install and place in operation not later than July 1st, 1911, a water purification plant which will meet the approval of the State Board of Health, or secure a new source of supply satisfactory to said Board.

The roll call for the yeas and nays upon the adoption of this motion resulted as follows: Yeas, Drs. Stanton, Crossland, Warner, Palmer, Chapman, Miller and Mr. Hartzell.

Nays, none.

The Secretary presented the following communication from the Blanchester Water Company:

"BLANCHESTER, O., Sept. 27th, 1909.

DR. C. O. PROBST, *Sec'y of S. B. H., Columbus, O.*

DEAR SIR: The Blanchester Water Company are contemplating enlarging their reservoir and water supply that they may furnish some water to the railroad company for steam purposes.

The situation with us is about as follows: We furnish water to the village for fire purposes and for steam purposes at the plant, and for public watering troughs. As compensation for this the village pumps the water and allows the water company the revenues from the sale of water to private consumers. We sell no water for drinking purposes, nor is it wanted here for drinking or cooking purposes, and for bath, bowl, sink and water closets.

We would be pleased to have you tell us if your Board would consider any of the above enumerated uses for "domestic purposes" such as is contemplated under the Bense Act, and would your Board require that we submit plans for your approval of such enlargement or if no water was sold or used for drinking purposes would same come under the provisions of the Bense Act?

By answering the above you will confer a favor on

THE BLANCHESTER WATER COMPANY,
By E. W. STRAWN, *Sec'y.*"

A report of the acting chief engineer upon the water supply of Blanchester was presented, and after consideration of same, it was moved by Dr. Chapman and seconded by Dr. Warner that the request of the water company to enlarge the reservoir system be granted, and that the board of trustees of public affairs of Blanchester and The Blanchester Water Company be notified that the owners of the water works, whether the present owner, some new company or the village shall have purchased the water works, will be required to purify the present supply or seek a new supply within a reasonable time after the expiration of the present franchise in 1914.

Those voting in the affirmative were: Messrs. Stanton, Crossland, Warner, Palmer, Chapman, Miller and Hartzell.

In the negative, none.

The Board then took up for consideration the plans and specifications for proposed sewerage and sewage purification for the city of Warren.

It was moved by Dr. Warner and seconded by Dr. Miller that the plans for proposed changes in the sewerage system, new sewers, and sewage purification works for the city of Warren, submitted on September 28th, 1909, by Mr. Alexander Potter of New York City, consulting engineer, be approved on the following conditions:

1st. That detail plans of storm water overflows, pumping station with screen chamber, and sewage purification works, be submitted to and receive the approval of the engineer of the State Board of Health before construction is begun;

2nd. That samples of all filtering material be submitted to and receive the approval of the engineer of the State Board of Health before being put in place;

3rd. That the area of the sludge beds be doubled:

4th. That devices whereby the filter effluent may be disinfected be placed along the effluent channel from the filters; and

5th. That this approval be considered void unless construction on the intercepting sewer and purification works shall have been begun by June 1st, 1911.

Those voting in the affirmative were: Messrs. Stanton, Crossland, Palmer, Warner, Chapman, Miller and Hartzell.

In the negative, none.

The Board then took up for consideration proposed change in the water supply for Cedar Point, a summer resort.

It was moved by Dr. Miller and seconded by Mr. Hartzell that the plans submitted by The Pittsburg Filter Manufacturing Company of Pittsburg, Pa., on September 21st, 1909, acting for The Cedar Point Resort Company, for a general scheme of purifying by mechanical filtration water to be taken from the lagoons at Cedar Point, be approved on the following conditions:

1st. That full detail plans be submitted to the State Board of Health and be approved by the Board's engineer before construction is begun;

2nd. That these detail plans make provision for possible future extension in the number of filters, the size of coagulating basin, and the size of clear water basin;

3rd. That samples of all filtering material be submitted to and receive the approval of the engineer of the State Board of Health before being placed;

4th. That both filters be equipped with automatic rate controller and loss of head gauges;

5th. That a suitable room be built for use as a laboratory and office; and

6th. That this approval be considered void unless the purification plant is completed by July 1st, 1911.

Those voting in the affirmative were: Messrs. Stanton, Crossland, Warner, Palmer, Chapman, Miller and Hartzell.

In the negative, none.

The Board then took up for consideration proposed sewage purification for the village of Monroeville.

It was moved by Dr. Palmer and seconded by Dr. Miller that the Board rescind its former action in approving sewers for Monroeville (October 25th, 1905) in so far as this relates to the submitting of plans for sewage purification works at this time.

Those voting in the affirmative were: Messrs. Stanton, Crossland, Palmer, Warner, Chapman, Miller and Hartzell.

In the negative, none.

The Secretary presented the following communication from the secretary of the board of public service of Zanesville:

"ZANESVILLE, OHIO, October 12th, 1909.

C. O. PROBST, M. D., *Secy., State Board of Health, Columbus, Ohio.*

DEAR SIR: The Board of Public Service requests that you secure for this city, at as early a date as possible, some definite and final action by your Board upon a well system as a source of water supply, viz., either definitely approving or disapproving such a source as a supply.

Very respectfully,
M. L. J. LOGSDON, *Secy.*"

He stated that upon receipt of this communication he telegraphed to the secretary as follows:

"Do you want Board to approve well system submitted June 15, 1909?"

To this telegram the secretary, Mr. M. L. J. Logsdon, replied:

"Yes, approval or disapproval. Must have it to know position in further action on water question."

The question then being upon the approval of plans for a new water supply for the city of Zanesville, to be obtained from wells located on the Hague Farm, so-called, submitted by the clerk of council, Mr. Neil Starkey, on June 15th, 1909, it was moved by Dr. Warner and seconded by Dr. Miller that these plans be disapproved.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Palmer, Chapman, Miller and Hartzell.

In the negative, none.

The Secretary presented a communication from the clerk of the village of Berea, stating that there had been no intention to make any change in the public water supply of the village without having same approved by the State Board of Health; that they were acting in good faith in endeavoring to prevent the use of the water for domestic purposes, and enclosing a public notice issued by the board of public affairs calling attention to an ordinance passed by council, prohibiting the use of the public water supply for domestic purposes and warning them not to use the water for drinking or cooking purposes.

The communication was filed without action.

The Secretary reported that after repeated requests to do so the village of Bourneville had failed to appoint a health officer, and he recommended that Mr. Alvin A. Loiry be appointed health officer for the village, at a salary of $25.00 per year.

It was moved by Dr. Palmer and seconded by Dr. Warner that Mr. Alvin A. Loiry be appointed health officer of Bourneville, to serve in lieu of a board of health, for one year at a salary of $25.00.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Palmer, Chapman, Miller and Hartzell.

In the negative, none.

Application for a license to conduct a maternity boarding house and lying-in hospital, located at 3910 Cedar Avenue, Cleveland, Ohio, was presented from Mrs. Grace Mills.

It was moved by Dr. Warner and seconded by Dr. Chapman that this applicant be granted a license.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Palmer, Chapman, Miller and Hartzell.

In the negative, none.

A report of the work done in the laboratory during the last quarter was then presented.

The question of legislation was then taken up for consideration.

A bill for the appointment of district medical inspectors was read and on motion of Dr. Chapman, seconded by Mr. Hartzell, adopted.

On motion of Dr. Warner, seconded by Dr. Palmer, the Secretary was instructed to change the act establishing the State Board of Health so as to provide a ten dollars per diem for members instead of five dollars as at present.

A bill providing for medical inspection of schools was then read, and on motion of Dr. Warner and seconded by Dr. Miller this bill was approved.

The Secretary was authorized to request the finance committee of the legislature to make an appropriation of from eight to ten thousand dollars for a traveling tuberculosis exhibit.

On motion of Dr. Palmer, seconded by Dr. Warner, the Secretary was instructed to prepare a bill providing for the production of diphtheria antitoxin for free distribution.

The Secretary recommended, that certain changes be made in the statutes relating to contagious and infectious diseases. These changes were adopted as read, with the exception of the section relating to measles, whooping cough and chicken-pox.

On motion of Dr. Warner, it was voted to so amend the section relating to these diseases that the attending physician will be required to report cases of such diseases to the local board of health, or health officer, and that such board or health officer shall be required to placard the premises where such diseases are reported to exist.

On motion of Dr. Chapman, arrangements for the joint meeting of the State and local boards of health in January were left to the president and secretary.

Matters previously acted upon by mail were then taken up for a viva voce vote as follows:

It was moved by Dr. Palmer and seconded by Dr. Stanton to confirm the Board's action of June 24th, 1909, approving a source of public water supply for the village of Delta, to be obtained from drilled wells located on a four-acre tract of land near the north corporation line and just east of the valley of Bad Creek, as shown on plans submitted by The Riggs and Sherman Company of Toledo, Ohio, on the following conditions:

1st. That before contracts are awarded, a full set of detailed plans in duplicate be submitted to and receive the approval of the State Board of Health.

2nd. That unless construction is begun before July 1st, 1910, this approval be considered void.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Palmer, Chapman, Miller and Hartzell.

In the negative, none.

It was moved by Dr. Miller and seconded by Dr. Warner to confirm the Board's action of July 10th, 1909, approving a proposed sewer for West Lafayette, as requested in a communication from Mr. George B. Adams, mayor, received March 27th, 1909, the sewer being described as beginning at Prairie Pond, extending through Center Street to Platt Street, thence west through Platt Street to Kirk Street, thence in a northerly direction to Plain Hill, thence encircling the hill and discharging into the Tuscarawas River at a point about half a mile west of Kirk Street, provided:

1st. That before the contract is awarded for the construction of said sewer, the council of West Lafayette pass an ordinance strictly prohibiting house connections thereto and also prohibiting its use for the reception of sink drainage, cesspool overflows, or any domestic or sanitary wastes other than ordinary street washings.

2nd. That if construction on the proposed sewer is not begun before August 1st, 1910, this approval be considered void.

Those voting in the affirmative were Messrs. Stanton, Crossland, Palmer, Warner, Chapman, Miller and Hartzell.

In the negative, none.

It was moved by Dr. Warner and seconded by Dr. Stanton that the action of the Board of July 15th, 1909, be confirmed approving plans for proposed additions to water works and proposed sewage purification plant for the Home of the Ohio Soldiers, Sailors, Marines, their Wives, Mothers and Army Nurses, at Madison, Lake County, submitted by The Riggs and Sherman Company of Toledo, Ohio, consulting engineers, on July 6th, 1909, provided:

1st. That a small screen chamber, satisfactory to the State Board of Health, be placed on the main sewer before the sewage enters the sedimentation tank.

2nd. That the combined settling tank and dosing tank be reduced to a total period of flow of twenty-four hours based on a population of 100 and a water consumption of 30 gallons per capita.

3rd. That detailed drawings of the dosing devices be submitted to the State Board of Health for approval before the plant is built.

4th. That the depth of sand in the filters be increased to 3 feet, thus making the total depth of filtering material 4 feet.

5th. That the underdrains to the filters be made of vitrified tile pipe.

6th. That the filters be located as far north on the State's land as practicable.

7th. That samples of the filtering material for the sand filters be submitted to the State Board of Health for approval.

8th. That this approval be void after August 1st, 1911, unless construction shall have been begun before that date.

Those voting in the affirmative were Messrs. Stanton, Crossland, Palmer, Warner, Chapman, Miller and Hartzell.

In the negative, none.

It was moved by Dr. Stanton and seconded by Dr. Palmer to confirm the Board's action of August 2nd, 1909, approving the revised plans for sewage purification for the above named Home, at Madison, submitted by The Riggs and Sherman Company on July 20th, 1909, provided:

1st. That an area of 0.2 acre be provided for the intermittent sand filters.

2nd. That the authorities of the Home agree to increase the filtering area of the intermittent sand filters, when in the opinion of the State Board of Health this may become necessary.

3rd. That the underdrains be surrounded by material graded from fine to coarse to prevent clogging.

4th. That the beds be divided into four units of two groups each, each group to be supplied by one siphon from the dosing chamber.

5th. That the condition embodied in the Board's previous action, namely, that this approval be void after August 1st, 1911, if construction is not begun before that date, be reaffirmed.

Those voting in the affirmative were Messrs. Stanton, Crossland, Palmer, Warner, Chapman, Miller and Hartzell.

In the negative, none.

It was moved by Dr. Stanton and seconded by Dr. Palmer to confirm the Board's action of July 23rd, 1909, approving plans for sewerage and sewage purification for the village of Carthage, submitted July 6th, 1909, by Mr. Clinton Cowen, county engineer of Hamilton County, provided:

1st. That plans, in duplicate, for the automatic dosing apparatus be submitted to and receive the approval of the State Board of Health before being installed.

2nd. That samples of all filtering material be submitted to and receive the approval of the State Board of Health before being placed.

3rd. That this approval be considered void after August 1st, 1911, unless construction shall have been begun before that date.

Those voting in the affirmative were Messrs. Stanton, Crossland, Palmer, Warner, Chapman, Miller and Hartzell.

In the negative, none.

It was moved by Dr. Chapman and seconded by Dr. Miller to confirm the Board's action of August 2nd, 1909, approving plans for water works for the village of Delta, submitted by The Riggs and Sherman Company of Toledo, consulting engineers, on June 28th, 1909, with the previous conditions; namely, that unless construction is begun before July 1st, 1910, this approval be considered void.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Palmer, Chapman, Miller and Hartzell.

In the negative, none.

The authorities at Delta were notified that analyses of water from the proposed public supply wells made in the laboratory of the State Board of Health indicated the presence of an excessive amount of iron which would no doubt give rise to complaint on the part of consumers, due to the discoloration of the water as it is drawn from the top and the staining of plumbing fixtures and fabrics in the laundry. To this end the Board strongly advised that as soon as funds could be made available the village should install a suitable plant for removing the iron; that while such a plant might prove rather expensive so far as cost of construction is concerned, it would prove very economical in operation, as no additional machinery or help would be required.

It was moved by Dr. Stanton and seconded by Dr. Warner to confirm the Board's action of August 6th, 1909, approving a proposed site for a district hospital for tuberculosis for Allen, Auglaize, Mercer and Van Wert counties, consisting of about 40 acres of land, being a part of a farm owned by Mr. Berryman, and located about two and one-half mile southwest of the court house at Lima, Ohio, and being the site inspected by Dr. Byron Stanton, president of the Board, on July 22nd, 1909.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Palmer, Chapman, Miller and Hartzell.

In the negative, none.

It was moved by Dr. Palmer and seconded by Mr. Hartzell to confirm the Board's action of August 23rd, 1909, approving plans for sewerage and sewer purification for the Ohio Soldiers' and Sailors' Orphans' Home near Xenia, submitted on August 10th, 1909, by Mr. H. W. Woodward, general manager of The Cleveland Engineering Company of Cleveland, subject to the conditions:

1st. That samples of filtering material be submitted to and receive the approval of the engineer of the State Board of Health before being placed;

2nd. That the area of the sludge bed be increased to 1200 square feet; and,

3rd. That this approval be considered void unless construction shall have been begun by January, 1910.

Those voting in the affirmative were Messrs. Stanton, Crossland, Palmer, Warner, Chapman, Miller and Hartzell.

In the negative, none.

It was moved by Dr. Chapman and seconded by Dr. Miller to confirm the Board's action of August 4th, 1909, rescinding its former action as regards permitting overflow storm sewers for the city of Warren, and permitting the use of combined sewers where necessary, provided:

1st. That the quantity of storm water to be intercepted meet the approval of the State Board of Health; and,

2nd. That the design of the purification works meet the approval of the State Board of Health.

Those voting in the affirmative were Messrs. Stanton, Crossland, Palmer, Warner, Chapman, Miller and Hartzell.

In the negative, none.

It was moved by Dr. Chapman and seconded by Dr. Stanton to confirm the Board's action of August 30th, 1909, approving plans presented by Mr. David L. Stine, architect, on August 17th, 1909, for the county hospital for tuberculosis for Lucas County, to be located on the infirmary grounds.

Those voting in the affirmative were Messrs. Stanton, Crossland, Palmer, Warner, Chapman, Miller and Hartzell.

In the negative, none.

It was moved by Dr. Stanton and seconded by Dr. Palmer to confirm the Board's action of August 30th, 1909, approving plans presented by Messrs. Harpster and Bliss, architects, on August 13th, 1909, for the county hospital for tuberculosis for Summit County, to be located on the infirmary grounds.

Those voting in the affirmative were Messrs. Stanton, Crossland, Palmer, Warner, Chapman, Miller and Hartzell.

In the negative, none.

It was moved by Dr. Palmer and seconded by Mr. Hartzell to confirm the Board's action of September 3rd, 1909, disapproving of the present public water supply of Willoughby, which was never submitted to the State Board of Health for approval as required by law, the results of an investigation of this supply showing it to be entirely unsatisfactory from a sanitary standpoint and unsafe, their recent outbreak of typhoid fever appearing to be attributable to the use of this polluted supply. Also advising the authorities to at once take steps looking towards a new supply, or the proper purification of the present supply.

Those voting in the affirmative were Messrs. Stanton, Crossland, Palmer, Warner, Chapman, Miller and Hartzell.

In the negative, none.

It was moved by Dr. Chapman and seconded by Dr. Miller to confirm the Board's action of September 7th, 1909, approving plans for sewerage and sewage purification for the village of Jefferson, submitted May 6th, 1909, by Mr. E. J. Crisp of Elyria, consulting engineer, upon the conditions:

1st. That three beds may be built as a present installation provided it is understood that the fourth bed will be added when the sewage flow exceeds an average rate of 100,000 gallons per twenty-four hours;

2nd. That the sedimentation tanks and dosing chamber will be covered in a satisfactory manner if at any time such cover, in the opinion of the State Board of Health, becomes advisable;

3rd. That detailed drawings of the automatic apparatus and samples of all filtering material be submitted to and receive the approval of the engineer of the State Board of Health before being put in place;

4th. That details of design of the screen chamber, underdrains of filters, and distributing troughs on surface of filters, be modified to the satisfaction of the engineer of the State Board of Health before construction is begun;

5th. That all exposed slopes and embankments be carefully sodded before any filtering material is put in place; and,

6th. That this approval be considered void unless construction shall have been begun by August 1st, 1910.

Those voting in the affirmative were Messrs. Stanton, Crossland, Palmer, Warner, Chapman, Miller and Hartzell.

In the negative, none.

It was moved by Dr. Stanton and seconded by Dr. Palmer to confirm the Board's action of September 9th, 1909, approving an additional water supply for Logan, to be obtained from two drilled wells located on the water works property upon the following conditions:

1st. That the tops of the wells be so constructed as to effectually prevent the entrance of flood waters;

2nd. That all salt water or water otherwise of objectionable quality be shut out by suitable casings; and,

3rd. That this approval be considered void if the wells are not completed and in use by September 1st, 1910.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Palmer, Chapman, Miller and Hartzell.

In the negative, none.

It was moved by Dr. Stanton and seconded by Dr. Warner to rescind the Board's action of September 9th, 1909, approving a new water supply for Zanesville known as the Smith system of natural filtration, an investigation of which was requested on July 17th, 1909, by Mr. J. P. Rhinehart, president of the board of public service, upon the conditions:

1st. That further well point tests be made over area proposed for location of strainer system;

2nd. That complete detailed plans embodying description of proposed methods of construction be submitted to and receive the approval of the State Board of Health before construction is begun;

3rd. That it is understood that the State Board of Health does not affirm that results will be satisfactory though preliminary investigations were rather favorable; and further, that if in the opinion of the State Board of Health the water fails to prove of satisfactory quality, the city agree to improve the supply by proper means or seek a new supply to meet the approval of said Board; and,

4th. That this approval be considered void unless construction shall have been begun not later than July 1st, 1910.

Those voting in the affirmative were Messrs. Stanton, Crossland, Palmer, Warner, Chapman, Miller and Hartzell.

In the negative, none.

It was moved by Dr. Palmer and seconded by Dr. Warner to confirm the Board's action of September 15th, 1909, approving the site proposed as a location for public water supply wells for the city of Urbana, lying just to the eastward of the Pennsylvania Railroad tracks and to the southward of Bloomfield Avenue, upon the conditions:

1st. That sufficient land be owned or controlled by the city so that no well used as a source of public supply will be nearer than 400 feet to any building, habitation, or other possible source of contamination;

2nd. That before construction is begun on the water works plant, the quantity available be ascertained so far as this is feasible by means of thorough pumping tests, which tests shall be conducted in a manner satisfactory to the engineer of the State Board of Health;

3rd. That before any contracts are let for the construction of the water works, complete plans and specifications of the water works system be submitted to and receive the approval of the State Board of Health; and,

4th. That this approval be considered void unless the complete plans and specifications above referred to are submitted not later than January 1st, 1910.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Palmer, Chapman, Miller and Hartzell.

In the negative, none.

It was moved by Dr. Warner and seconded by Dr. Chapman to confirm the Board's action of October 4th, 1909, approving plans for sewers and sewage purification plant for Wilberforce University, submitted September 11th, 1909, by Messrs. Bradbury and Shute, consulting engineers, upon the following conditions:

1st. That the purification plant be enlarged in a manner and to the extent deemed necessary by the State Board of Health, when in the opinion of said Board the plant is no longer capable of producing a satisfactory effluent;

2nd. That samples of the filtering material be submitted to and receive the approval of the engineer of the State Board of Health before such material is put in place; and,

3rd. That this approval be considered void unless the sewers and sewage purification plant are completed by October 1st, 1911.

Those voting in the affirmative were Messrs. Stanton, Crossland, Warner, Palmer, Chapman, Miller and Hartzell.

In the negative, none.

It was moved by Dr. Warner and seconded by Dr. Chapman to confirm the Board's action of September 9th, 1909, granting a license to Evangeline Reams to conduct a maternity boarding house and lying-in hospital known as Salvation Cottage, at 73 North Harris Avenue, Columbus, O.

Those voting in the affirmative were Messrs. Stanton, Crossland, Palmer, Warner, Chapman, Miller and Hartzell.

In the negative, none.

It was moved by Dr. Warner and seconded by Dr. Chapman to confirm the Board's action of September 22nd, 1909, granting a license to Mrs. M. E. Huffman to conduct a maternity boarding house and lying-in hospital at 3142 West 70th Street, Cleveland, O.

Those voting in the affirmative were Messrs. Stanton, Crossland, Palmer, Warner, Chapman, Miller and Hartzell.

In the negative, none.

It was moved by Dr. Chapman and seconded by Dr. Stanton to confirm the Board's actions approving health officers, appointed by council, to serve in lieu of a board of health.

Those voting in the affirmative were Messrs. Stanton, Crossland, Palmer, Warner, Chapman, Miller and Hartzell.

In the negative, none.

The Board then adjourned.

Attest: C. O. PROBST,
Secretary.

RESUME OF QUARTERLY REPORTS

PRESENTED TO THE BOARD BY THE SECRETARY.

JANUARY MEETING.

INFECTIOUS DISEASES.

Investigations of infectious diseases have been made as follows:

October 21st, 1908, scarlet fever at Tippecanoe City.

November 3rd, smallpox at Zanesville.

November 21st, typhoid fever at Gnadenhutten.

November 21st, scarlet fever at Fredericksburg.

November 29th, scarlet fever at Deavertown.

December 2nd, smallpox at Pemberville.

December 13th, typhoid fever at Wilberforce.

January 12th, diphtheria at Deavertown.

Other investigations were made as follows:

October 21st, Dr. Crossland and the chief engineer visited Cambridge to investigate conditions complained of under the Bense Act, arising from the pollution of Wills Creek by the sewage of Cambridge.

October 28th, Mr. Hartzell and the chief engineer visited Rittman to investigate conditions complained of under the Bense Act arising from the pollution of Chippewa Creek by manufacturing wastes from the Ohio Box-board Company, of Rittman.

October 29th, Mr. Hartzell and the chief engineer visited Alliance to investigate conditions complained of under the Bense Act arising from the pollution of the Mahoning River by the sewage from Alliance.

November 5th, Dr. Chapman and the chief engineer visited Delphos to investigate conditions complained of under the Bense Act arising from the pollution of Jennings Creek and the Auglaize River by the sewage from Delphos.

November 6th, Dr. Chapman and the chief engineer visited Elmore to investigate conditions complained of under the Bense Act arising from the pollution of the Portage River by the sewage from Elmore.

November 10th, Dr. Palmer and the chief engineer visited East Orwell to investigate conditions complained of under the Bense Act arising from the pollution of a water course by The Ohio and Pittsburg Milk Company, of East Orwell, by creamery wastes from said Company's plant.

November 12th, Dr. Stanton visited Blue Ash in Sycamore Township, Hamilton County, to investigate a nuisance caused by the dumping of wastes from a slaughter house.

November 14th, Dr. Stanton and the chief engineer visited Wellston to investigate conditions complained of under the Bense Act arising from the pollution of Meadow Run by the sewage from Wellston.

November 20th, Dr. Stanton and the chief engineer visited Miamisburg to investigate conditions complained of under the Bense Act arising from the pollution of the Great Miami River by the sewage from the National Military Home.

November 22nd, Dr. Warner visited Marysville to investigate conditions complained of under the Bense Act arising from the pollution of Mill Creek by the sewage from Marysville.

December 15th, Dr. Stanton visited a proposed site for a county tuberculosis hospital for Warren County.

December 22nd, Dr. Stanton investigated sewerage conditions at Cincinnati.

January 11th, 1909, Dr. Stanton visited Pleasant Ridge to investigate a nuisance caused by the sewage from a number of houses in that place.

Upon request, Mr. Parker was sent to West Manchester to investigate an outbreak of typhoid fever, on November 27th, 1908. He found in all 28 cases of the disease. From his report it appeared that the outbreak grew out of pollution of some shallow wells. A copy of his report was sent to the health officer, with the urgent recommendation that the rules governing the construction of privies as given in the report should be strictly enforced throughout the village.

WATER SUPPLIES AND SEWERAGE.

Bucyrus, Springboro, Akron, New Vienna, Newark, Mansfield, East Liverpool, Girard, Huron, Hiram, Delaware, St. Henry, Sandusky, Marion, Fostoria, Lewisburg and Apple Creek were visited relative to a new water supply or a change or extension of the present supply.

Existing water supplies were inspected at New Vienna, Bainbridge, Greenfield, Hicksville, Corning, Glouster, Zanesville, Hillsboro, Lynchburg, Blanchester, Marietta, Rockford, Delphos, Van Wert, New London, Wellington, Berea, Chagrin Falls, Sidney, St. Marys, Vermilion, Sandusky and Bucyrus.

Existing sewerage and sewage purification works were investigated at Shepard (St. Mary's of the Springs), Kenton, Delaware, Hamilton and Fostoria.

College Hill, Mt. Sterling, Ney, Fremont and Xenia were visited relative to proposed sewerage; and in connection with creamery and city wastes, Sunbury, Eldorado, Cleveland, Toledo, Dayton, Hamilton, Cincinnati, Youngstown, Killbuck, Lorain, Sandusky and Huron were visited by one of the engineers.

The chief engineer visited Fostoria on account of existing sewerage, Sandusky to inspect the filtration plant under construction, Dayton to investigate electrolyzers for producing chlorine, Hamilton to look over location for possible future sewage purification, and the following places in response to petitions under the Bense Act: Greenville, Miamisburg, Cambridge, Alliance, Rittman, Elmore, Delphos, Marysville; and Fremont on account of proposed sewerage.

In compliance with a request from Mr. H. Carter, chairman of a citizens' committee, one of the engineers visited Mt. Sterling to confer with him and his associates in regard to proposed sewerage. As a result of his visit, the following suggestions were made to Mr. Carter on October 27th, 1908:

(1) The so-called sanitary cesspool and filters which individual citizens propose to install, would not be satisfactory.

(2) The sewage should be collected in properly designed sewers and conducted as rapidly as possible away from residences to a point where it can be satisfactorily purified.

Upon a written request, signed by eighty-four citizens of Wilmington, one of the engineers visited that village to investigate an alleged nuisance. A copy of the engineer's report was sent to the mayor and council, with the following comment: The condition of the run passing through the thickly built-up portion of the village undoubtedly constitutes a grave nuisance. The only really adequate remedy for the highly objectionable existing conditions, and probably worse future conditions, is the installation of an adequate system of sanitary sewers.

One of the engineers made an inspection of an alleged nuisance at Shepard, Franklin County, with special reference to the purification of the sewage from St. Marys of the Springs. Upon investigation it was found that a decided nuisance was caused by the pollution of Alum Creek at Shepard by the sewage from St. Marys of the Springs and Sister M. Vincentia of the institution was advised that something should be done as soon as possible to improve present conditions.

The report of one of the medical inspectors and one of the engineers upon conditions at Wilberforce University, where typhoid fever appeared, indicated the necessity of a suitable method of disposing of the sewage from the combined normal and industrial departments as well as from Wilberforce University and other buildings at that institution. It was found that the sewage from the combined Normal and Industrial departments is discharged at the head of a ravine, one-eighth of a mile from the institution, and that the sewage from the University is discharged on to the surface of the ground within about 100 feet of the building. Suitable means for properly disposing of the sewage should be installed. In addition to an improved method of disposing of the sewage, the campus of the combined normal and industrial departments should be properly drained. A copy of the report above mentioned was sent to the president of the University, and he was advised that an effort should be made to secure an appropriation from the legislature for these improvements.

One of the engineers investigated the sewerage at the Greene County Infirmary. The sewage from this institution is discharged through a sewer into the head of a gully which extends southward towards the Little Miami River for a distance of two miles. A very marked nuisance had been created near the mouth of the sewer and for some distance below, which should be abated. The only practical way to abate the nuisance would seem to be to establish a sewage purification plant, and the commissioners of Greene County were so informed.

On October 28th, 1908, after due investigation of a nuisance at Rocky River, said to be due to the discharge of sewage from the village of Lakewood, a copy of the resume and conclusions as reported by the investigating committee was sent to the mayor and council of the village of Lakewood, urging them to in the future take proper care in the operation of their sewage disposal plant and care of the sludge, to prevent the repetition of the conditions complained of.

An investigation of the Scioto River was made at the time of very low water. This showed that there was considerable local pollution of the three branches of the river at Marion, Kenton and Marysville, respectively: That while the sewage purification plant at Marion served to eliminate a local nuisance, there was yet a considerable pollution of the Little Scioto River by the effluent from the plant. There was also an approximately equal pollution of the stream by the storm water sewer above Rock Swale Ditch. Below Greencamp and approximately seven miles below Marion, the evidence indicated that the effect of the pollution by Marion had largely disappeared.

Sanitary drainage from the city of Kenton was also polluting the main Scioto River, and evidence indicated a continuance of this pollution for a considerable distance, but that it was largely removed by natural processes immediately below Greencamp. The investigation showed that under dry weather conditions there was no appreciable pollution of the main Scioto River by the drainage from Marysville. The analyses of the samples from the Columbus storage reservoir indicated that, although there was a gross pollution of the upper waters of the Scioto River, this pollution was largely eliminated from the stream by natural agencies. The water of the reservoir contained considerable organic matter, the evidence of past pollution, also a high chlorine content, but the bacterial analyses indicated that in this respect the water was of very satisfactory quality. The sample from the intake of the Columbus water works indicated a pollution of the stream below the storage dam, on which account it would be desirable to carry the water from the reservoir to the purification plant by a closed conduit rather than in the open bed of the stream.

An investigation of the water supply and general sanitary conditions of Tippecanoe City showed that at least one of the so-called storm sewers was receiving closet wastes contrary to the approval of the State Board of Health. In regard to the public water supply, it was found that the supply wells were located in rather close proximity to habitations, with their accompanying privies, and the village authorities were advised that in order to safeguard the quality of the water in the future it would be advisable to secure a reconstruction of the privies within at least 500 feet of the public water supply wells, in accordance with the usual rules and regulations of this Board.

An investigation of the public water supply of London developed the fact that the water was of good quality from a sanitary point of view. It was observed, however, that the bacterial content of samples of the water examined was not as low as might be expected from water drawn at so great a depth as is reached by their public supply wells, and this was attributed to the possibility of more or less contamination reaching the collecting reservoirs which had never been cleaned since installed.

It was observed during the above investigation that the sewage purification plant was operating in an improper manner, due to the failure of the automatic dosing devices to perform their function.

An investigation of the water supply of the village of Vermilion indicated a very satisfactory water. A number of recommendations were made to insure continued efficiency of the filters.

An investigation of the public water supply of Hillsboro showed that the public water supply was of excellent quality from a sanitary point of view, being above the average of Ohio ground waters. It appeared that a number of private wells were being used which were exceedingly liable to contamination. It was observed that the sewerage of Hillsboro is inadequate, and the authorities were urged to employ a competent engineer to advise them in regard to making provision for the proper disposal of their sewage.

An examination at Medina of the recently completed new water supply and system of sewers showed that the works have been constructed in general accordance with the plans submitted to the State Board of Health for approval. The water furnished by the new water works this far is of satisfactory quality. The sewage purification plant was not being properly operated, and the authorities were urged to place the sewerage system under the general supervision of a competent superintendent, such superintendent to conform to instructions given by the local authorities and this Board.

As a result of an investigation of the public water supply and general sanitary conditions of the village of Greenfield, the local authorities were informed that there was a probability of the public water supply being polluted by a nearby graveyard and through the open standpipe; that neither of the public supply wells, one of which was built in 1893 and the other during the past summer, had received the approval of the State Board of Health, as required by law; and that the water was of unsanitary quality. They were advised to seek a new supply. It was found that so-called storm water sewers were receiving large quantities of domestic wastes, the outlets for which had never been approved by this Board; and the local authorities were so notified.

An examination was made of the public water supply of Trotwood, and it was found that there was some danger of polluting the wells by privies in their vicinity. It was suggested to the secretary of the water works company that these privies should be changed in a manner to accord with the rules recommended by this Board for the construction of privies.

An inspection of the sewage purification plant at the Girls' Industrial Home at Delaware, October 28th, 1908, showed that the plant was purifying the sewage of the institution very satisfactorily. The effluent from the sand filters was of low turbidity, free from odor and presumably non-putrescible. The character of the effluent was such that no criticism could be made as to the efficiency of the plant in the final purification of the sewage of the institution as regards the chemical purity of the final effluent. Leakage from the northerly sewer had ceased. The small volume of rinse water flowing in the central sewer will soon be prevented. The efficiency of the sewage purification plant was high as regards chemical purity of the effluent from the sand filters. There was some leak, however, from the sprinkling filter which might permit partially purified sewage to be washed into the river. The attention of the trustees of the institution was called to this.

The assistant engineer had a conference with the authorities of Sandusky relative to the construction of their filter plant. The engineering department also reviewed the plans and list of laboratory apparatus for Sandusky, and advice was given relating thereto.

An examination was made of the public water supply of Canal Fulton. The water showed a marked deterioration over samples analyzed in the laboratory of the Board in 1902 and 1906. This was attributed to the prevailing dry weather and the inadequate protection of the surface of the ground in the vicinity of the springs. The deep wells supply was found to be quite satisfactory. It was advised that the springs be abandoned as a public water supply for the time being, and that further examinations would be made when the conditions as to rainfall were more normal.

An examination of the public water supply of Mineral City, consisting of wells and springs, showed that the springs were not adequately protected against sources of pollution. The well water, on the other hand, seemed to be entirely satisfactory for a public supply, though it suffered deterioration by storage in the open reservoir on App Hill.

It proved from the investigation of the public water supply of Minerva that all of the existing wells had been installed since 1898, and we have no record that these wells were ever approved by this Board, or that plans were ever received for that purpose. The authorities were notified of the results of the investigation, and that any extension of the present supply must receive the approval of this Board, as required by law. It appeared that the water being furnished was of good quality, although it had deteriorated slightly since analyzed in 1904. This falling off in quality was attributed to the proximity of the wells to a number of privies. It was advised that these be reconstructed along lines laid down by this Board for the construction of privies within 500 feet of the public supply-wells.

A copy of the report of the committee that investigated the complaint against the Victor Stamping Works, at Twightwee, in Symmes Township, Hamilton County, was sent to the superintendent of the works, and it was reported that the company was willing and desirous to make whatever changes might be deemed necessary to remove the conditions complained of.

The Ohio and Pittsburg Milk Company, of East Orwell, Orwell Township, Ashtabula County, was furnished with a copy of the report of the Board's committee upon an investigation of a nuisance caused by the discharge of wastes from its creamery, and an offer was made to co-operate with them in solving the problem of the disposal of their wastes to avoid creating a nuisance.

The McJunkin-Straight Dairy Company, West Andover was furnished with a copy of the report of the Board's committee outlining the manner in which they could abate the nuisance complained of.

The investigation of the complaint against the city of Wellston by Milton Township, Jackson County, under the Bense Act, revealed the fact that a sewerage system had been constructed at Wellston without having received the approval of this Board, and the attention of the board of public service of that city was called to this.

The Governor and Attorney-General signed the orders adopted by the Board for sewage disposal plants under the Bense Act on January 4th, 1909, for the following places, to wit: Alliance, Van Wert, Bowling Green and Greenville. A copy of the order, officially signed by the Governor and Attorney General on January 4th, 1909, for these improvements, was sent to the mayor and council of each of the towns named above.

APRIL MEETING.

The following inspections or visits have been made during the quarter:

INFECTIOUS DISEASES.

March 5th and 6th, typhoid fever at Niles.
March 8th, smallpox at Loveland.
March 11th, smallpox at Williamsburg.
April 10th, smallpox in Washington Township, Hardin County.
April 17th, smallpox at Hillsboro.

WATER SUPPLIES AND SEWERAGE.

Proposed water supplies at Delta, Canal Fulton, Oak Harbor, Willoughby, St. Henry, Akron, Newark, Lowellville and Pleasant Hill; existing water supplies at Attica, Bellevue, Bloomville, Delaware, Greenwich, Greenfield, Leesburg, Niles, Oberlin, Sandusky, Circleville, Washington C. H., Sabina, Bluffton, North Baltimore, Prairie Depot, Ironton, Shreve, Martins Ferry, Crestline, Ashland, Galion, Glouster, Bryan, Montpelier, Continental, Leipsic, Oakwood and New Vienna; and water purification at Oberlin, Upper Sandusky, Columbus, Shelby, East Liverpool, Ashtabula, Cincinnati and Pomeroy were investigated.

Existing sewerage and sewage disposal plants in the course of construction at Orrville, Canton, Camp Perry, Columbus, State Sanatorium at Mt. Vernon, Jefferson, Galion, Wadsworth and Medina; proposed sewerage and sewage disposal at Mt. Gilead, Niles, Cincinnati, Massillon, Upper Sandusky, Camp Perry and Louisville were investigated.

Bense Act inspections were made by the engineering department at Bucyrus, Elmore, Blanchester, Thackery, Rittman and New Philadelphia.

A detailed study and report has been made of the public water supplies at the following places: Chagrin Falls, Wellington, Corning, Hicksville, Bainbridge, Berea, Delphos, Sidney, Van Wert, Lynchburg, Sabina, Niles, New Vienna, Circleville, Washington C. H. and St. Marys. It was shown that the supply for Hicksville, Delphos, Sidney, Van Wert, Chagrin Falls, Lynchburg, Washington C. H., Sabina, Circleville, St. Marys and New Vienna, was of good quality from a sanitary standpoint. The supply for Wellington is inadequate and not of good quality. Corning's supply is not used for drinking purposes; it is polluted and inadequate. The private wells are most of them unsafe. The supply at Bainbridge shows increasing pollution, probably from numerous privy vaults near the wells. Berea is using water from Rocky River for domestic purposes in violation of the Board's order of 1899. They have installed a rough kind of filter, totally inefficient, without authority of the Board.

The ground water supply at Niles is at times inadequate and an emergency intake to the Mahoning River is brought into use. Following the use of the river water a number of cases of fever appeared. These were investigated by Dr. Platter and found to be typhoid fever. About fifty cases in all were reported.

Copies of the reports of these investigations in each case were sent to those in charge of the water works and also the health authorities, with a letter giving appropriate advice.

Complaint was again made in regard to stream pollution at Lynchburg by the distillery of Freiburg and Workum. It will be recalled that the Board gave them assistance in designing a plant to recover waste products, which they have been doing at a profit. It seems, from the investigation made, that floor washings and miscellaneous wastes still enter the stream in sufficient quantity to occasion some nuisance. The company was notified of this, and Mr. Freiburg came to Columbus for a conference, and promised to do anything necessary to prevent further trouble.

JUNE MEETING.

The following inspections or visits have been made during the quarter:

INFECTIOUS DISEASES.

April 27th, smallpox at Geneva.

May 3rd, smallpox in Dodson Township, Highland County near Lynchburg.

May 10th, smallpox at Hillsboro.

May 10th, smallpox at Salineville.

May 15th, smallpox at Seville.

May 20th, smallpox at Plain City.

May 22nd, smallpox at Carey.

May 23rd, smallpox in Jefferson Township, Madison County.

May 26th, smallpox at Leesburg.

May 29th, smallpox at Upper Sandusky.

June 1st, smallpox at Marysville.

June 15th, smallpox at Canal Winchester.

WATER SUPPLIES AND SEWERAGE.

Proposed water supplies at Delta, Newark, Willoughby, Cambridge, Dayton and St. Henry, were investigated.

Existing water supplies were examined at Delphos, St. Marys, Circleville, Cuyahoga Falls, Wadsworth, Dalton, Shreve, Middletown, Wilmington, Blanchester, Sycamore, Camp Perry, Loveland, Mt. Sterling and Ashtabula.

The following places were visited by the engineering department for the purposes mentioned: Dennison, to examine existing sewerage; Jackson, Carthage, Jefferson, Youngstown and Covington to investigate proposed sewerage; The State Sanatorium at Mt. Vernon, Wyoming, St.

Marys, Lima and Oberlin to scrutinize sewage purification plants in the course of construction; Collinwood, Pettisville and Columbus Grove to inquire into nuisances complained of; Columbus, Dayton, Cleveland, Cincinnati, continuing research relative to city wastes disposal: Sunbury, creamery wastes, and Athens, slaughter house wastes. Delphos was visited relating to the complaint under the Bense Act.

Public water supplies have been studied in detail and reports made thereon at Ashtabula, Bluffton, Crestline, Galion, Glouster, Greenfield, Leesburg, Loveland, North Baltimore, Prairie Depot and Wilmington. It was shown that the supplies at Bluffton, Crestline, Galion, Glouster, North Baltimore and Prairie Depot were of good quality from a sanitary point of view. Recent changes have improved conditions somewhat in the new well at Greenfield. There is still evidence, however, of some organic contamination. The Ashtabula plant is capable of producing a potable water of excellent quality if intelligently and faithfully operated. Leesburg's supply in inadequate. Loveland is using a well, never approved by the State Board of Health, which fortunately is of good quality. No material deterioration in the quality of the supply of Wilmington has taken place since the new wells have been put in service, although there is evidence of some remote source of contamination.

Copies of the reports of these investigations were in each case sent to those in charge of the water works and the health authorities, with a letter giving appropriate advice.

Investigation showed the existence of a nuisance at Collinwood by the discharge of sewage into Rockefeller Creek, and it was learned in connection therewith that proposed sewerage for Collinwood had never received the approval of this Board.

OCTOBER MEETING.

INFECTIOUS DISEASES.

Outbreaks of smallpox were investigated as follows:

July 3rd, Crooksville.
August 11th, at Orrville.
September 2nd, at Sycamore.
September 8th, at Mt. Gilead.
September 13th, at McCutchenville.
September 13th, Auburn Township, Geauga County.
September 14th, at Bowling Green.

Two investigations were made on account of diphtheria:

August 24th, at Loramie, where an epidemic of diphtheria was found, there having been a dispute over the diagnosis.

September 23rd, at Marie Stein, Mercer County. Four cases and two deaths had occurred.

ANTITOXIN.

During the past eleven months we have distributed 2,811 immunizing doses and 3,665 curative doses of antitoxin. We have a record of the various distributing stations throughout the state having supplied for use in indigent cases 593 immunizing doses and 833 curative doses. This amount of antitoxin represents a cost to the local boards of health and counties of $1,591.80. At the market price this would amount to $6,236.00; a saving of $4,644.20. This represents 3,700,000 units.

TUBERCULOSIS.

September 29th, the Secretary visited Norwalk to confer with representatives of Erie, Huron and Lorain counties in regard to a district tuberculosis hospital for these counties.

TYPHOID FEVER.

August 4th, and again on the 15th, one of the engineers visited the Girls' Industrial Home at Delaware, upon the request of the superintendent, to investigate an outbreak of typhoid fever, about fifteen cases having occurred. The investigation served to discover a number of unsanitary conditions. A copy of the engineer's report was sent to the superintendent, with advice to have all lavatories, dining room, kitchen and pantries screened.

September 27th, in response to an invitation from the superintendent, the Secretary and the chief engineer made an inspection of the institution, and a report on the sanitary conditions is being prepared. All cases of typhoid are convalescing.

July 27th, Dr. Platter investigated an outbreak of typhoid fever at Batavia. He found in the village and outlying districts eleven cases, and all of the physicians reported an unusual number of cases of bowel trouble. There appeared to be no sickness among farmers and there is no milk route. The distance between cases rendered it unlikely that contact or flies were the causation factors. As a number of wells and cisterns are still in use it was thought that the cases originated either from polluted wells or cisterns, or that the purification plant was not properly performing its functions. Samples of water were examined. The river water was found to be badly polluted. The analysis showed that while the particular sample of purified water, furnished from the public water supply, was safe to drink, unless care is taken in operating the filters the effluent may readily become contaminated.

July 30th, Greenville was visited by Dr. Platter, where he found sixteen cases of typhoid, twelve of these being on one dairyman's route.

The man's wife had typhoid and he had been nursing her. Analysis of a sample of the water from the well at this dairy showed pollution.

At Salem, the health officer reported that nineteen of the twenty-three cases reported, were patrons of one dairyman whose wife had typhoid. The sanitary conditions of the dairy were found to be good, but investigation disclosed that the milk bottles, after being sterilized by steam were cooled by rinsing in cold water from the well, which, upon examination, was found to be contaminated.

August 17th and 18th, Dr. Platter visited Mansfield where they have had about one hundred and forty cases of typhoid fever; sixteen occurring in July, one hundred in August and the remainder in September. The authorities were advised to employ nurses to visit all houses where the disease was present to see whether the directions of the physician relative to disinfection were being carried out; and they were also advised to appoint nine assistant milk inspectors, that all dairies furnishing milk to Mansfield might be visited and all dairies excluded where a case of fever was found. The report of the milk inspector showed that fifteen cases of fever were found in the country district among milk producers.

Jeromeville, a nearby town, reported fifteen cases traceable to ice cream manufactured in Mansfield.

August 4th, 5th, and 6th, Dr. Platter investigated an outbreak of typhoid at Oberlin, where there were sixteen cases, two of which had come to Oberlin sick, while it was found that nine others had had abundant opportunity to contract the disease outside of the town. But one local common source was obtainable and that was fresh vegetables, gotten directly or indirectly from one gardener. Investigation of this garden revealed that the land was irrigated and the vegetables sprayed with water from Plum Creek, known to be polluted. The authorities were advised to disinfect and clean outside closets, to protect the city water from possible contamination at the garden spoken of above, to prohibit the gardener from spraying vegetables with polluted water from the creek, and, most important, to see that all discharges from each typhoid patient were thoroughly disinfected. They were also advised to adopt rules and regulations governing the sale of milk and the appointment of a competent milk inspector. September 16th the report was that they were still having a few additional cases.

August 10th and 11th, Dr. Platter investigated typhoid at Willoughby, where he found twenty-four cases. Everything pointed to the public water supply as the cause of the outbreak. An investigation of the supply, which had never been approved by the State Board, showed it to be contaminated. The authorities were advised to at once take steps looking towards a new water supply or the proper purification of the present supply.

September 3rd, Dr. Platter investigated an outbreak of typhoid at

Germantown, where he found twenty-four cases, twenty-three being on one milk route. Investigation of the dairy farm showed it to be in fair sanitary condition. The family, consisting of the dairyman, his wife and two children, were all in good health and none had ever had typhoid. The entire output of the dairy is bottled, and among late cases is that of the wife of a confectioner who sells bottled milk from this dairy. The possible cause of the outbreak is an infection carried from one house to another through improperly cleansed bottles. Samples of water from the well at the dairy were examined.

September 9th, Dr. Platter investigated an outbreak of typhoid fever at the Mansfield Reformatory. He found twenty-three cases, one additional case, a guard, having gone to his home in Youngstown. Previous to the outbreak there were two cases on the dairy farm, children of the superintendent of the dairy, one of them had opportunity to contract the disease in Mansfield. So far as could be learned the dairyman and members of his family had nothing whatever to do with the milking or sterilizing of the utensils. Milk cans are sterilized by steam at the institution, and the milking is done by inmates. One of the milkers, it developed, had typhoid in 1907. Two Widals were taken from this patient and negative findings resulted. Widals were also taken from all the boys employed in the milking or in handling the milk at the institution. A laboratory examination of eight samples of feces did not detect a bacillus carrier.

The water supply at the institution is derived from five sources, two springs and three driven wells, samples of which were examined in our laboratory.

September 27th, 28th and 29th, Dr. Platter visited Oxford Township, Butler County, and Israel Township, Preble County, to investigate recurrent outbreaks of typhoid fever. He found six cases, the probable source being a case of walking typhoid, a woman who prepared dinner for a picnic gathering, infecting the milk and food.

August 28th, the acting chief engineer visited Holloway to investigate the water supply, sanitary conditions, and cases of typhoid fever. The examination of the water supplies practically eliminated these as the possible source of the typhoid cases, but needed improvements were discovered and advice given the authorities relative to the same, and also for improving sanitary conditions, and they were furnished a set of suggested rules for the construction and maintenance of privies.

In response to a request from the board of health of Lakewood, the acting chief engineer visited Rocky River, September 4th, to look into unsanitary conditions complained of. He found that an epidemic of typhoid fever had prevailed but was under control, and that while the cause could not be ascertained, a great many cases were apparently due to personal contact. The condition of many of the private wells and the lack of cleanliness in certain parts of the village would tend to spread the disease should it gain a foothold. The authorities were requested to obtain detailed information relative to each case that occurred and upon receipt of this more definite conclusions as to the probable origin of the disease could be reached, and if the same warranted, further investigation would be made by the Board.

Typhoid has also prevailed at Covington, Portsmouth, Akron, Loudonville, West Mansfield, Wellston and other points through the Hocking Valley, West Manchester and Zanesville.

INVESTIGATIONS UNDER THE BENSE ACT.

Complaints under the Bense Act were investigated as follows:

July 6th, Collinwood was visited by the acting chief engineer relative to the pollution of Rockefeller Creek by the sewage from the village.

July 7th, the acting chief engineer visited the office of The Ohio Boxboard Company in Cleveland and made arrangements for conducting a series of experiments for purifying the wastes from their plant at Rittman. These experiments have been begun.

July 26th, and September 3rd, Elmore was visited by the acting chief engineer relative to the pollution of the Portage River by the sewage from Elmore; and also in connection with the proposed water supply.

September 3rd, in response to a petition received August 23rd from Pulaski Township, Williams County, Dr. Chapman and the acting chief engineer visited Bryan to investigate the pollution of streams and ditches in the township by the sewage of Bryan.

September 10th, in response to a petition under the Bense Act, received August 25th, from the board of health of Dayton, Dr. Stanton, the Secretary and the acting chief engineer visited that city to investigate the alleged pollution of their public water supply.

September 13th, in response to a petition from the board of health of Ironton under the Bense Act, received September 10th, the acting chief engineer visited Ironton to investigate the public water supply which has been installed not in accordance with the conditions of approval of this Board. This investigation is still under way.

WATER SUPPLIES AND SEWERAGE.

Investigations of proposed water supplies were made at Blanchester, Bradford, Carthage, Cedar Point, Elmore, Lakeside, Newark, Pomeroy, Roseville, Urbana and Zanesville.

Examination of conditions at Lakeside revealed the same careless manner of operating the filters found on previous inspections. Wells are being driven for a new supply but a satisfactory one has not yet been obtained.

The public water supplies of Ashland, Bryan, Continental, Greenwich, Mt. Sterling, Montpelier, Oakwood and Sycamore have been studied in detail and reported upon. It was shown that the quality of the Greenwich water is poor and that the supply was installed without the approval of the Board having been secured.

At Continental analyses of the water taken from the reservoir indicated a moderate degree of contamination, probably due to a leaky condition of the reservoir.

Letters embodying statements in the reports were sent to the authorities and advice for improving or maintaining the present good quality given.

At Monroeville it was found that the water supply had been installed contrary to the approval of this Board in that no provision had been made for the purification of the supply; and also that a sewer system was being constructed before plans for the purification of the sewage had been submitted to and received the approval of the Board.

Several visits have been made to Akron by the engineers, and one of the engineers spent a period of three weeks in Akron, for the purpose of making a thorough study of the conditions that might tend to cause pollution of the water supply. These studies involved a collection and analysis of about 150 samples; thorough sanitary survey of the series of lakes from which the water supply is derived, a number of float measurements for the purpose of determining the general trend of currents in Summit Lake with reference to the water works intake and also to ascertain the effect of winds on these currents. The investigation has not yet been completed.

Sewerage and sewage purification plants under construction were inspected at Carthage, Camp Perry, Chagrin Falls, College Hill, Eaton, Elmwood Place, Hartwell, Mt. Gilead, Lockland, Madison, State Sanatorium at Mt. Vernon, Geneva, Sylvania, Wyoming and Westerville.

The Westerville plant was found in a neglected condition, showing no evidence of any painstaking or intelligent operation. The attention of the authorities was called to the provisions of the Bense Act and they were notified that in a short time another investigation would be made and if the plant was not found to be in good condition the Board would be compelled to resort to the procedure necessary to cause the village to place the plant in proper condition and to employ an operator who would be satisfactory to the State Board of Health.

The following places were visited relative to proposed sewerage and sewage purification: Alliance, Cleveland Boy's Farm Colony at Hudson; Jefferson, Leipsic, the Home at Madison, New Boston, Xenia O. S. and S. O. Home and Wilberforce University, Put-in-Bay, West Milton, West Lafayette and Willoughby Township, Lake County (Erieside).

A number of visits were made to Sunbury and it was found that the efficiency of the plant of the Sunbury Co-operative Creamery Company had materially increased during the month of July, owing, it was thought, to the neutralization of the acid in the applied wastes with soda ash. About thirty-five pounds of this chemical are added in the dosing tank subsequent to each discharge of the siphon. September 18th, your Secretary, Mr. Kimberly, and Mr. Hansen visited Sunbury and arranged with the creamery company to continue measurements of flow of waste and the collection of samples from time to time.

Regular examinations have been made at Cincinnati, Cleveland, Dayton and Columbus relative to the investigation of city wastes disposal and street cleaning; and Canton, Steubenville and Zanesville have been visited for the purpose of conducting thorough tests of the garbage incinerators in use at these cities. These tests were carried out with the plant operating under ordinary conditions and also operating under what was believed to be the most economical conditions consistent with effecting a complete and rapid combustion of the refuse.

Nuisances have been investigated at Youngstown, Union City, Darke County; Brookville, Perry Township, Montgomery County; New Concord, Milo, Marion Township, Franklin County; Madison, Middlefield, Harrison Township, Montgomery County; Dayton, and Arlington Heights.

JANUARY MEETING, 1910.

[Under this heading is included that part of the Quarterly Report referring to work during 1909.]

INFECTIOUS DISEASES.

Inspections of smallpox outbreaks have been made as follows:

October 18th, 1909, at Osborn.

November 4th, in Washington Township, Preble County.

November 13th, Pike County, five miles southeast of Omega.

November 16th, the health officer of Jackson Township, Pike County, found a well marked case of smallpox near Waverly, and a few days later found two negro laborers sick with smallpox in a Norfolk and Western Railway car and another case outside the car. There were from fifty to seventy-five men in the gang and he ordered the patients taken to the gravel pit near Waverly, where they were cared for, and then vaccinated all the men who could not show a good scar of former vaccination. There were some forty or fifty in all. Nine cases occurred in this camp, well taken care of by the health officer of the township, and there has been no further spread of the disease there.

November 18th, Gilead Township, Morrow County.

December 4th, Dr. B. R. Bales was called to a camp of the Norfolk and Western Railroad laborers in Pickaway County to see a negro who was sick in a railway car. Two days later he visited him and suspected smallpox and so notified the health officer of the township. The following day the camp was moved between Hayesville and Miller Station and on the 8th day of December the health officer of the township, Pickaway, tacked two smallpox cards on the car and cautioned the negroes in the car, seven in all, not to leave. He then asked for instructions and Dr. Dick was sent to the camp and gave the instructions needed. December 10th Dr. Bales insisted upon a strict quarantine and the employment of guards, and as the negroes had come from Virginia the township board of health refused to act and asked the State Board of Health to take charge. Dr. Bales, by authority of the president of the Board, was immediately appointed medical inspector in charge of the quarantine and he secured four guards who were sworn in as special officers. December 11th, Dr. Dick again visited the camp and assisted Dr. Bales in vaccinating thirty-one of the laborers. No one was permitted to leave the camp but all except the sick men were allowed to work, accompanied by a guard. As soon as a case recovered the clothing, bedding, etc., were appraised and burned and the man furnished with new clothing. January 8th, all patients having recovered they were discharged. The cost of this outbreak amounted to $781.45.

November 29th, Zanesville.

October 19th, Dr. Platter investigated an outbreak of typhoid fever at Roscoe, just across the river from Coshocton. There were nine cases in the village, traceable to two sources, a polluted well and infected milk. The daughter of the milkman had contracted the disease elsewhere, came to her father's, suffered a relapse and died. Four of the cases had been obtaining milk from this family. Disinfection seems to have been thorough and there has been no spread of the disease.

Diphtheria outbreaks were investigated at Grand Rapids, October 19th, and Hoytville, November 27th.

WATER SUPPLIES AND SEWERAGE.

Cambridge, Elmore, Newark and Wooster were visited relative to a new water supply, or a change or extension of the present supply.

Existing water supplies were inspected at Carthage, Ironton, Kent, Newton Falls, St. Bernard, Springfield, Wilmington, Willoughby, East Palestine, Columbiana and Vermilion.

Alliance and Jackson were visited relative to proposed sewerage, and plants under construction were inspected at The Boys' Farm at Bratenahl (Cleveland), College Hill, Elmwood Place, Eaton, Middletown, Mt. Gilead, State Sanatorium at Mt. Vernon, Oberlin, Oxford, Pickaway County Infirmary, Sebring, and the O. S. and S. O. Home at Xenia.

October 16th, Dr. Stanton investigated and reported upon the site proposed for the sewage purification plant at Elmwood Place.

The acting chief engineer investigated the method of city waste disposal in Baltimore, Boston, New York City and Washington, D. C., and one of the assistant engineers visited Columbus, Cincinnati, Cleveland, Dayton, Marion and Mansfield in the interest of this work.

Edison, Findlay and Sunbury were visited in connection with creamery wastes, and the following places relative to complaints under the Bense Act: East Orwell (The Ohio and Pittsburg Milk Co.), Twightwee (The Victor Stamping Works), Rittman (The Ohio Boxboard Company), and New Philadelphia.

Complaint was made by residents living near the foot of Hickory Street, Chillicothe, relative to a nuisance created by the improper operation of a submerged 10-inch sewer, expected to take care of the dry weather flow from a 24-inch combined sewer laid in the street. One of the engineers visited Chillicothe on October 22nd and found upon investigation that the complaint was well founded. A letter was addressed to the mayor and council based upon the investigation and advice given for the abatement of the nuisance.

A petition was received, October 16th, from the trustees of Pleasant Township, Hardin County, complaining of the pollution of a small branch of the Blanchard River passing through the land of Frederick Steiner. Dr. Warner, as a member of the committee appointed to investigate the complaint, visited the township and reported that he found practically only a drainage ditch, which was not receiving sufficient pollution to create a public nuisance, and as the stream has no dry weather flow it is not available for stock watering purposes at all times. It was therefore considered that this was purely a local matter and not one to be dealt with under the Bense Act. The trustees were notified that they had authority to abate the nuisance, and in case they failed to act in the matter it could be dealt with through the courts.

November 22nd, a communication was received from the health officer of Portage Township, Summit County, complaining of the odors from a rendering plant of The Akron Soap Company. It was stated that the odors were due to improper methods of operation and that the company was willing to correct same, as might be suggested by the State Board of Health. One of the engineers visited the plant, made an investigation and report, a copy of which was sent to the company and the complainant, with suggestions for improving the equipment of the plant.

December 9th, 1909, the orders of the Board under the Bense Act were signed by the Governor and the Attorney General, requiring the village of Collinwood to build such connecting sewers as are necessary to convey the entire sewage flow to the outfall of the Cleveland interceptor on or before August 1st, 1910, and to take such steps as are necessary to prevent the contamination of Rockefeller Creek; and requiring the city of Niles to provide a larger supply of water of satisfactory quality on or before October 13th, 1910, and to purify its sewage in a manner satisfactory to the State Board of Health on or before that date.

PUBLIC WATER SUPPLIES.

REPORT ON PROPOSED WATER SUPPLY FOR APPLE CREEK.

On December 29th, 1908, a letter was received from Dr. W. H. Winkler, mayor of Apple Creek, requesting an examination of a proposed source of public water supply for that village. One of the engineers of the Board visited Apple Creek on December 31st, 1908, to make the necessary investigation and reported as follows:

The village of Apple Creek is in the north-central part of the state, in Wayne County. It has a population of approximately 400 and the area within the corporation limits is about one square mile. From the top of the highest ground to the railroad track, which is at approximately the lowest part of the village, there is a difference in elevation of approximately 120 feet. In general, the village is built on a ridge, one side of which slopes to the head of a ravine at which point is located the spring considered as a source of the proposed public supply.

The industries of the village comprise a grist mill and a planing mill, but the residents are mostly farmers. It is the purpose to install a public water supply for fire protection and for general domestic use.

There is at present no public water supply and private wells and privies are in general use. It is stated that there are 21 fountains or artesian wells in the village, having an average depth of about 100 feet. There are also 30 drilled wells which do not flow but which also have an average depth of 100 feet. The material through which these wells are driven varies with their location; in the higher ground they pierce a shaly sandstone; in the lower part of the village the wells pierce first approximately 10 feet of fine clay, beneath which lies a bed of sand and gravel. No rock is encountered in the lower parts of the village within 100 feet of the surface. It is in the lower part of the village also that the flowing wells are encountered. At no time have any of the private wells been suspected of causing disease.

The proposed water works are to comprise the development of a suitable source, a pumping station, a storage reservoir and a distribution system. The pumping station is to contain one unit driven by a gasoline engine to have a guaranteed capacity of 100 gallons per minute. The reservoir is to be a concrete basin located on Cemetery Hill, the highest point in the village, and is to be 35 feet in diameter by 12 feet deep; 7 feet depth is to be in excavation. While the height of the reservoir is not sufficient to give the necessary pressure for fire protection in the highest parts of the village, it is contemplated to use a fire engine where necessary.

No source of supply has as yet been definitely selected, and it was to examine a large spring as to its availability for a source that the writer visited Apple Creek on December 31st. As previously stated, this spring is at the head of a ravine in the lower part of the village and about one-half of the built-up territory of the village is on land sloping toward the spring. Within a radius of 500 feet are to be found several privies, and one stable at about 150 feet distance containing several head of stock. Two privies are located within 150 feet of the spring, and on the high ground above are located about twenty houses.

The spring is about one-quarter of a mile from the center of the village on the property of W. Haley, and has a very strong flow of approximately 500,000 gallons daily, even during the extremely dry period now prevailing. The ground immediately above the spring has been filled with gravel, but it is stated that the water originally outcropped from a sandstone rock.

At 10:45 A. M., December 31st, a sample was taken from the spring, and the plates necessary to determine the total number of bacteria were poured at Apple Creek soon after collection of the sample. Other determinations were from samples shipped to the laboratory. The results of the analysis of this sample indicate a water of very satisfactory quality for both domestic and industrial uses.

Owing to the unsatisfactory location of the spring it was decided to examine some of the wells used as private supplies, and with this intention a sample was taken from a drilled well on the property of J. W. Ramsey, also about one-quarter of a mile from the center of the village but on considerably higher ground. The well is 3 inches in diameter, 77 feet deep, and penetrates approximately 60 feet of drift and 17 feet of sandstone. Before pumping, water stood at a point 44 feet beneath the surface, but was found first at 60 feet beneath the surface. During a fire on the day previous to sampling, there had been a very heavy draft on the well and the water from it was slightly turbid. It had a slight inky taste characteristic of ground waters containing iron.

The analysis of the sample indicates a softer water than that from the spring on the Haley property and, in general, one of satisfactory quality for domestic and industrial purposes except its iron content (0.8 part per million).

A well on the adjacent property, about 100 feet distant, was also examined. This well is 70 feet deep and contains but little casing. The well on the Ramsey property contains 60 feet of casing so that its water is derived from the lower strata only. In the second well there was a very pronounced inky taste and, when collected in a bottle, the sample contained visible red particles of iron which subsides very rapidly. No sample from this well was collected for analysis.

The authorities of Apple Creek were then notified that analyses showed that both these waters were safe for domestic purposes, yet the location of the spring with reference to habitations was such as to render its use dangerous as a source of public water supply. That the drilled well might be used so far as quality of the water was concerned, but in view of the fact that there were flowing wells not far from the center of the village, it would probably be more economical to develop the public supply from such a well. It was therefore recommended that they make further investigation of possible sources of ground water free from iron and otherwise of suitable quality in a location which should be 400 or 500 feet from any habitation or possible source of pollution.

In April, 1909, the Apple Creek authorities requested the Board's approval of the spring and stated that they would use all precautions to eliminate pollution from the residences from the territory above the spring.

After consideration, on July 6th, 1909, the Board approved as a source of public water supply for Apple Creek, the flowing spring located about one-fourth mile from the center of the village on the property of W. Haley, provided:

1st. That all privies on the watershed above the spring be constructed and maintained according to the following rules and regulations:

(a) All privies shall be provided with watertight receptacles resting at or above the surface of the ground, the receptacles to be so placed and constructed that they may be readily inspected and removed.

(b) As soon as filled all receptacles shall be emptied and the material removed at least one-fourth mile beyond the village limits.

(c) It shall be the duty of the health officer, or his representative to inspect all privies on the watershed above the spring not less frequently than once in two months, and to prosecute persons not complying with these rules.

2nd. That no privies be permitted within 200 feet of the spring, and that no cesspools of any character be constructed on the watershed above the spring.

3rd. That as soon as the village shall have provided itself with a system of sanitary sewers, all privies on the watershed shall be abandoned.

4th. That no animals be kept within 200 feet of the spring.

5th. That the flow of water from the spring be confined in a basin or reservoir the sides of which are watertight and extend at least 3 feet above the surrounding surface of the ground, and that the basin be covered to protect the water from contamination and to exclude the direct rays of the sun.

REPORT OF THE EXISTING WATER SUPPLY OF BEREA WITH SPECIAL REFERENCE TO NON-FULFILLMENT OF CONDITIONS OF APPROVAL IMPOSED BY THE STATE BOARD OF HEALTH.

The following report is based upon a visit to Berea by one of the engineering assistants, on December 15, 1908.

The public water supply of Berea was installed under the engineering supervision of Mr. L. E. Chapin of Canton, consulting engineer, in 1900. The primary reason for the introduction of a public water supply was the desire to have more adequate fire protection. It was at first hoped to secure a supply that would also be satisfactory for general domestic uses, but efforts to find water from ground sources resulted in failure. Attention was next turned to an abandoned stone quarry in the southern portion of the village, which had filled with water and was capable of yielding a considerable quantity by seepage from the interstices of the rock faces. It was not believed, however, that the water obtained from the quarry would be sufficient to meet all demands and accordingly the village, through its consulting engineer, requested permission of the State Board of Health to use water from the east branch of Rocky River, provided the supply was used for fire protection only. The request also stated the willingness of the village to purify the supply whenever it was deemed advisable to use the public supply for domestic purposes, if in the opinion of the State Board of Health, purification could be adequately effected by so-called mechanical filters. The Board voted to approve the supply, but only upon the following conditions:

a. That the water shall not be used for domestic purposes from either source unless purified to the satisfaction of the State Board of Health.

b. That in case the village decides to make use of the water for fire and purposes other than domestic purposes, an ordinance shall be passed by the village council prohibiting the use of the water for domestic purposes.

c. That the completed plans for purification of the water shall be presented to the State Board of Health for approval whenever it shall be decided to use the water for domestic purposes.

Notice of this action was sent to the consulting engineer on September 25, 1899.

On May 28, 1900, in accordance with condition "b," the following ordinance was passed by the village council:

"WHEREAS, The State Board of Health has given permission to use the water supply of the village of Berea in furnishing water for all purposes other than domestic purposes, providing an ordinance is passed by this council prohibiting the use of said water for domestic purposes. Now, therefore,

Be it ordained by the council of the incorporated village of Berea, as follows:

Sec. 1. That it shall be unlawful for any one to use the water furnished from the supply of said village for domestic purposes.

Sec. 2. That any one violating any of the provisions of this ordinance shall on conviction thereof pay a fine not exceeding $10.00 for each offense.

Sec. 3. This ordinance shall take effect and be in force from and after its passage and legal publication.

(Signed) C. F. Lane,
Mayor.

(Signed) O. R. Stone,
Clerk.

Passed May 28, 1900."

So far as could be learned, the ordinance is entirely disregarded and the public supply is generally used for drinking and for domestic purposes.

During the past summer, in order to improve the appearance of the supply as it is delivered to consumers, the river water in passing into the quarry was caused to pass through a filter about 4 feet square and having as a filtering medium a 12-inch layer of gravel varying in size from ½ to 1 inch, and an 18-inch layer of charcoal the particles of which vary in size from 1 to 2 inches.

From the above, it will be observed that the water supply of Berea has been used in violation of the conditions of approval imposed by the State Board of Health in 1899, and also in violation of its own ordinance prohibiting the use of the supply for domestic purposes. Further, in violation of the conditions of approval of the State Board of Health, the village has attempted to filter the river supply without submitting plans for such filtration to the State Board of Health for approval.

The practice of using the river and quarry water in an unpurified state is unquestionably dangerous, though the few analyses that have been made in the laboratory of the State Board of Health show the water from the river as well as the quarry to be a safe water for domestic consumption at the times the samples were taken. The watershed above the intake, however, is rather populous, having a population of about 60 per square mile, a portion of which is assembled in three or four small villages adjacent to the stream or its tributaries. It is quite possible in the absence of complete control of the watershed, for the water to become at any time dangerously contaminated. It has been suggested by certain village authorities that a patrol of the watershed be maintained, but in Columbus and elsewhere such patrol has not proved entirely effective.

This matter having been brought to the attention of the authorities of Berea, the following communication and explanation of conditions was received from the village clerk:

> "As to the building of a purification plant for our public water supply the village has done nothing, and unless the State Board of Health should compel the same, the village officials do not desire to go to the expense of building such a plant at this time, owing to the fact that our bonded indebtedness at the present time is $104,255.80.
>
> "At the time the State Board of Health gave permission for the use of the present source of water supply, the council of the village passed an ordinance,

on May 28, 1900, prohibiting the use of the water for domestic purposes, this being done in good faith, and yet the fact remains that a number of our citizens are using the water contrary to the ordinance. We probably have at least three hundred of our houses in the village being furnished for bath and sanitary purposes, and the only absolute way of the officials to prevent the water being used in a domestic way would be to disconnect all house and lawn connections, leaving only the fire hydrants for fire protection. Such drastic steps would work great hardships, and would be a serious calamity to the village. The board of public affairs have in this week's paper inserted a notice to the citizens, a copy of which I mail you under separate cover.

"In previous correspondence we infer that your engineer has reported that we have put into use a sort of filtration system, without the same being approved by your board. This is not true. The water works board constructed a small pit at our intake from the river in which was placed charcoal and gravel to act as a filter, or rather strainer of the water taken from the river. This has never been announced as a filtration system, and in fact the writer doubts whether one hundred of our citizens know of its existence.

"The officials of Berea village appreciate the care for the welfare of its people that is being exercised by the State Board of Health and desire to lend their aid in every reasonable way, and yet at the same time they trust that your honorable body may see its way clear not to force the building of a purification plant at the present time."

REPORT ON PROPOSED CHANGE IN WATER SUPPLY FOR CEDAR POINT.

On September 21, 1909, preliminary plans and specifications for water purification works to be installed at Cedar Point summer resort were received from the Pittsburg Filter Manufacturing Company with request for approval of same by the State Board of Health. The plans and specifications were reviewed by the engineering department, and also an examination was made on the ground October 4, 1909. The following report was submitted:

Cedar Point is located on a long narrow neck of land forming the principal enclosing arm of Sandusky Bay and lying to the northeastward of the city of Sandusky. All of the land on the point is owned by The Cedar Point Resort Company. The total area comprised in the developed portion of the point is about one-half square mile. The topography is generally flat and is diversified only by sand dunes seldom rising to a greater height than 8 feet above lake level. The natural appearance of the point has been greatly altered by planting of trees and grass. The geological formation shows sand to a depth of 30 to 40 feet. below which is limestone rock of great thickness. Interstratified with the sand are occasional deposits of organic matter. In almost any locality water may be derived from wells penetrating the sand, but only in limited quantities. The water is of generally satisfactory quality for drinking purposes but contains iron in objectionable amounts. Occasionally a well penetrating one of the organic deposits produces a water with an oily taste. Deep wells have been drilled penetrating the rock, but these yield only water highly impregnated with hydrogen sulphide and other minerals which render it objectionable. The water derived from wells in the sand deposits is practically free from the possibility of contamination at any point on the grounds for the reason that all of the sewage is conveyed from the various buildings through a riveted steel pipe sewer which discharges in a cove to the southward about one-fourth mile distant from the nearest buildings. This seems to effect a fairly satisfactory solution of the sewerage problem since no nuisance is ever complained of and contamination of the ground is effectively prevented.

Cedar Point has had a rapid growth as a resort in recent years, and it is estimated that as many as 20,000 people may visit the place in a single day. The great majority of these, however, are transients and remain on the grounds for a comparatively few hours. There are hotel accommodations for about 2000 persons, and in addition to these there are about 500 employees who remain on the grounds. Thus what may be termed the permanent population would not exceed 3000. All of these figures, of course, refer to the three summer months as the place is closed down from the latter part of September until June. It is very difficult to fairly estimate the quantity of water that will be required, but indications from present pumping records are that 700,000 gallons per day during the height of the season is a liberal allowance.

EXISTING WATER SUPPLY.

The existing water supply is on the dual system; that is to say, there are separate supplies for drinking and for all other purposes. The drinking water is obtained from a series of driven wells and is pumped through a system of piping to the various buildings by a small boiler feed pump. The consumption of this water does not exceed more than 10,000 gallons per twenty-four hours. All other water required on the place such as for toilet purposes, laundry, kitchen, sprinkling, and fire protection, is obtained from a system of lagoons so-called. These lagoons are simply channels which have been artifically excavated in order to effect drainage of swampy area. Their picturesqueness has been developed by proper planting of trees and they are used to a considerable extent for boating. They are fed entirely by the waters of Sandusky Bay which surge back and forth in the lagoons in conformity to the variations that take place in the lake level. The water in these lagoons is given some circulation by pumping therefrom about 1,000,000 gallons of condenser water daily for the power plant. This water is discharged into the main sewer and assists in keeping the same thoroughly flushed Owing to the considerable amount of vegetation which is found in the lagoons at certain seasons of the year; the water therefrom has a distinct color and frequently a taste and odor. It is claimed, however, that by dragging the lagoons with bags of copper sulphate just before the season opens, no more difficulty is encountered from this cause during the remainder of the summer.

PROPOSED CHANGE IN WATER SUPPLY.

It is the desire of the officials of The Cedar Point Resort Company to obtain a water supply that may be used for all purposes excepting fire protection, and which will be entirely satisfactory from a sanitary point of view. For fire protection it is proposed to use the lagoon water direct, the same to be pumped through a separate pump which is maintained for this emergency only. The company seems to appreciate that the reputation of the place depends largely on its healthfulness, more particularly as this is affected by its water supply. A well supply might seem on the whole the most satisfactory, but owing to the iron content of the water and also its liability to objectionable tastes due to organic deposits within the sand, such a supply is not deemed feasible. Further, it is questionable whether a sufficient quantity could be derived from the fine sand which forms the point.

The next most satisfactory supply would appear to be one taken from Lake Erie at a considerable distance from shore. This, however, is not deemed practicable because the beach on the lake side is constantly building, because the water is very shallow for such a great distance from shore, and the sand is of such a character that the construction of an intake would be extremely costly. The only remaining source of supply is that obtainable from the lagoons. This water is not subjected to any direct contamination, though it has the disadvantage of occasionally containing organic growths (as already pointed out), which impart tastes and odors. It may also be subjected to contamination to a slight extent by sewage from Sandusky, but as most of this sewage is carried past Cedar Point by a strong current in a deep channel and as the distance from Sandusky is two miles, it is not believed that there need be much apprehension due to contamination in this way. All things considered, the lagoons seem to constitute the most satisfactory source for a supply and it has been decided to use the lagoon water purified in a mechanical filtration plant.

PURIFICATION PLANT.

The purification plant as shown on plans submitted is designed for a nominal capacity of approximately 700,000 gallons per twenty-four hours. The essential parts of the equipment comprise the following: Low lift pumps of the centrifugal type; coagulating basin; a coagulant plant; two filters; and clear well.

Sedimentation Basin. The sedimentation basin is 38 feet long, 25 feet wide, and 11 feet deep to the flow line. It is divided longitudinally through the middle by means of a baffle wall. Between each end of the baffle wall and the ends of the tank are left open spaces of about 12 feet in width. Near one end of the baffle wall and across one side of the basin is placed a dividing wall. The bottom of the basin is well sloped to a central drain, by means of which the precipitated deposits may be drawn off. Water from the low lift pumps is admitted into one corner of the basin opposite the dividing wall. The water flows into a weir chamber in which a constant head is maintained by means of a float and butterfly valve placed on the end of the influent pipe. After receiving the dose of coagulant, it passes over the weir, thence around the baffle, and back to the dividing wall. Supported by the dividing wall is a channel or skimming trough, over the side of which the coagulated water passes in a thin sheet. This trough discharges into a channel which conveys the water to the filters. The size of the coagulating basin is such as to afford a period of sedimentation based on the nominal capacity of the plant of 2.7 hours. It is believed that this will prove sufficient with the water to be handled.

Coagulant Plant. The plant for the preparation of the coagulant and the introduction of the same into the water consists of two coagulant tanks 4 feet in diameter by 4 feet in depth. Each of these is provided with a mixing box, and suitable pipe connections lead to an orifice tank. The orifice tank is so arranged, it is claimed, that the flow of coagulant will be porportional to the flow of water passing over the weir at the entrance to the coagulating basin. This device is not shown in detail on the plans.

Filters. There will be two filters of reinforced concrete construction, each of which is 14 feet long and 8 feet 6 inches wide. Thus each filter has a surface area of 119 square feet, which gives it a capacity, based on the rate of filtration of 125,000,000 gallons per day, of 340,000 gallons, or a total for the two filters of 680,000 gallons per twenty-four hours. There is nothing unusual in the construction of the filters. Longitudinally along the bottom is placed a manifold into which are screwed 1½-inch lateral pipes at 6-inch intervals and extending at right angles to the central manifold to the sides of the filters. These lateral pipes will be provided with numerous holes 3/32-inch in diameter and provided with brass bushings to resist wear. These holes will be used in lieu of strainers. The manifold system will serve the triple purpose of carrying off filtered water, distributing wash water, and distributing compressed air used in agitation.

The filtering material will consist of about 8 inches of gravel ranging in size from 3/16-inch to ⅝-inch. It is expected that the gravel will be placed in layers with the finest gravel on top so as to prevent sand from penetrating to the distributing pipes. On top of this will be placed about 2½ feet of filter sand which according to the specifications will have an effective size ranging from 0.35 m. m. to 0.45 m. m. with a uniformity co-efficient not to exceed 1.68.

Above the sand and longitudinally along the center line of each filter will be placed on overflow trough. This trough will have its crest 15 inches above the sand level and will be of ample dimensions to carry off all of the soiled wash water. The coagulated water will be admitted from the coagulated water channel, above referred to, into compartments 18 inches wide and extending across the front of each filter. These compartments are formed merely by placing a dividing wall across the width of the filter near one end. From these compartments the water will flow through the overflow troughs and thence on to the sand. With the filter in regular operation, the level of water therein will stand a foot or more above the tops of the overflow troughs. During washing these overflow troughs serve to draw off evenly from all parts of the filter the soiled wash water. This water will be discharged into the compartment at the front end of the filter and thence conveyed by a suitable connection into the sewer. Wash water will be supplied to the filters by a centrifugal pump taking its suction from the clear well. In addition to the above, the filters will have suitable connections for carrying off filtered water to the clear well, for supplying air to the manifold system, and for filtering to waste.

For the sake of reducing the cost of the plant, filter rate controllers and loss of head gauges have not been specified. As these devices could be obtained at a cost not to exceed $300, and further as they may be considered quite essential to the proper operation of the plant, more especially where expert attendance is not available, it is believed that thy should be included.

Clear Well. The clear well is 27 feet long and 19 feet wide. The maximum depth of water shown on the plans is 12 feet. This would bring the level of the surface of the water in the clear well to within 18 inches of the surface of the water in the filters, and therefore represents the maximum height of water that the clear well will ever contain. It is likely that under ordinary operating conditions, the depth of water will not exceed 7 feet. Based on a depth of 12 feet, the well would have a capacity of 46,000 gallons and based on a depth of 7 feet, it would have a capacity of but 27,000 gallons. This latter figure represents a storage period of but little over 0.9 hour. This storage period is so short that when the daily consumption of water approximates the nominal capacity of the plant, it will not be possible for the filters to meet the demands owing to the hourly fluctuations in consumption which may at times greatly exceed the nominal capacity of the filters. It is probable that for some time this clear well capacity will be sufficient, but ample provision should be made for future extension.

Superstructure. The superstructure is 41 feet long by 38 feet wide and covers half of the coagulating basin, all of the clear well, and both of the filters. It is divided into two rooms, one of which contains the filters and the coagulant plant; and the other is available for storage of chemicals. The building is to be built entirely of concrete with a nearly flat roof and has head room of but 8 feet. The plans show but eight small outside windows and two doors. It is not believed that these windows will admit enough light to give the bright and airy appearance that should obtain in a plant of this sort.

At a meeting of the State Board of Health held October 14th, 1909, these plans submitted by The Pittsburg Filter Manufacturing Company on September 21st, 1909, for a general scheme of purifying by mechanical filtration the water to be taken from the lagoons at Cedar Point, were approved upon the following conditions:

1st. That full detail plans be submitted to the State Board of Health and be approved by the Board's engineer before construction is begun;

2nd. That these detail plans make provision for possible future extension in the number of filters, the size of coagulating basin, and the size of clear water basin;

3rd. That samples of all filtering material be submitted to and receive the approval of the engineer of the State Board of Health before being placed;

4th. That both filters be equipped with automatic rate controllers and loss of head gauges;

5th. That a suitable room be built for use as a laboratory and office; and,

6th. That this approval be considered void unless the purification plant is completed by July 1st, 1911.

REPORT ON PROPOSED TEMPORARY ADDITIONAL WATER SUPPLY FOR DAYTON.

On May 6, 1909, the following resolution was received from the board of public service of Dayton:

> "*Resolved,* That the State Board of Health be notified that the Board of Public Service of the city of Dayton, Ohio, has ordered a series of six or eight wells to be placed in the Miami River in the city of Dayton abutting city property, just above the Steele Dam, and connect the same with a pump and with the water mains of said city at or near the junction of Stillwater Avenue and Locust Street for the purpose of obtaining an immediate temporary water supply until a permanent supply can be had, and permission is hereby requested of said State Board of Health to place and connect up said wells with the water mains of said city, and,
>
> *Be it further resolved,* That the clerk of this board be directed to certify a copy of this resolution to the said State Board of Health."

On May 19, 1909, one of the assistant engineers visited Dayton and made an examination on the ground. The following report was submitted:

The city of Dayton during the last several years has experienced a serious shortage in its water supply which is derived from a large number of wells in the valley of the Mad River in the northeastern part of the city. The board of public service through its consulting engineer, Mr. George H. Benzenberg, recently made an exhaustive study of available sources of additional supply. In accordance with the recommendations of the consulting engineer, the authorities propose to locate additional wells in the valley of Mad River a distance of several miles to the northeastward of the present wells, where it is believed very extensive gravel deposits which fill the old glacial valley of the river will furnish an adequate quantity of water to meet all demands for a number of years to come. The development of this proposed additional supply requires a large sum of money and at least several years for completion. In the meantime, Dayton is in immediate need of an increased supply, especially for the high districts in the northern part of the city.

It is therefore proposed to install a temporary supply to be derived from three or more tubular wells in the valley of the Great Miami River near the north corporation line. The site selected for the location of the wells is on the west bank of the river about opposite Pioneer Street and just above what is known as the Steele Dam. The surroundings of the site are not all that could be desired. To the southwestward is a thickly built up district which, however, is adequately sewered on the separate plan. The nearest houses to the site other than one small boat house, are about 150 feet distant. On the opposite side of the river to the northeastward is a summer park known as the "White City," which is unprovided with sewerage. The privy vaults at this resort, however, are at a great distance and are not likely to affect the quality of the water derived from the wells. The section of a test well which was sunk for the purpose of determining the quantity and quality of water available, shows approximately the following:

Material.	*Thickness of Stratum.*	*Depth to Bottom of Stratum.*
Soil	11 feet	11 feet
Fine gravel intermixed with sand	15	26
Gravel somewhat smaller than peas intermixed with sand	14	40
Coarser gravel somewhat larger than peas	27	67

The water in the well when not being pumped, stands at about ten feet below the surface of the ground, or at the approximate level of the water in the nearby river. The well is 8 inches in diameter and is cased to within 8 feet of its bottom. The remaining 8 feet is occupied by a

Cook strainer described as No. 24, which has slots approximately 1/32-inch wide. Pumping by means of a centrifugal pump, yielded water at the rate of about 400,000 gallons per twenty-four hours with a lowering of the water level in the well of about 9 feet. It thus appears that there is an abundant supply of water, and inasmuch as but 1,000,000 gallons per day are required to meet the additional demand, it is believed that three wells will prove sufficient. The water derived from the wells undoubtedly constitutes the underflow of the stream from the northward through great gravel deposits characteristic of streams in this vicinity.

The analysis of sample taken from the test well indicates a water of very good quality from a sanitary point of view and also satisfactory in other respects as compared with the existing supply. It should be stated, however, that the iron content is somewhat greater than in the existing supply and may give rise to complaint due to discoloration. The principal objection that may be advanced against the proposed supply is the possibility of future contamination from nearby habitations with continued and heavy pumping.

It is intended to pump the emergency supply from an auxiliary pumping station located at the intersection of Locust Street and the Miami Boulevard, several hundred feet distant from the wells. The pumping machinery will consist of several centrifugal pumps, already in possession of the water works department, and will be driven by electric motors.

It is not anticipated that the emergency supply will be needed at all times, but only during dry periods in the summer when the regular supply fails to give a sufficient yield; nor is it likely that the supply will be used any more than necessary owing to the uneconomical means of pumping used.

At a meeting of the State Board of Health held June 17th, 1909, this temporary additional water supply for the city of Dayton was approved provided:

1st. That, inasmuch as the proposed additional supply is of temporary character, this approval be considered void after July 1st, 1910, and that the proposed additional supply be permanently abandoned on that date unless reapproved by the State Board of Health;

2nd. That the proposed additional supply be used only in case the existing supply fails to yield a sufficient quantity of water for all the needs of the city; and,

3rd. That the city authorities take active steps to secure as soon as possible a permanent additional supply capable of meeting all demands, and to this end it is recommended that the plans of Mr. George H. Benzenberg be adopted.

REPORT ON PROPOSED ADDITIONAL WATER SUPPLY FOR DELAWARE.

On October 17, 1908, a communication was received from The Delaware Water Company, requesting an investigation by a representative of the State Board of Health of a proposed additional water supply. In accordance with this request, one of the assistant engineers visited Delaware on October 24, 1908. The following report was submitted:

The water works were installed in 1889. In seeking a supply at that time it was hoped to secure a sufficient quantity of water from gravel deposits in the valley of the Olentangy River, near the city. The first search for water was made in the river valley directly to the northward of the town, but no adequate supply was found until a point about four miles to the northward was reached. In this vicinity there lies a broad expanse of bottom land composed mostly of gravel deposits, and included within a large bend of the river. The total area of this bottom land is probably in the vicinity of 40 to 50 acres. The gravel deposits have a depth of about 20 to 22 feet and overlie limestone rock, which apparently forms the old valley floor. In order to derive ground water from these gravel deposits, a large circular brick well with a tributary infiltration gallery was constructed. The well is about 28 feet in diameter by 28 feet deep. It reaches entirely through the gravel deposits and penetrates about 5 feet into the bed rock. The infiltration gallery is about 300 feet long and practically parallels the bank of the river at a distance of 75 to 100 feet from the water's edge, and rests directly on the rock. The cross-section of this gallery is said to be 4 feet wide and 6 feet high. The sides are of rough, loosely laid stone masonry, and the top is composed of stone slabs. As an emergency provision, a river intake was installed which permits river water to enter the infiltration gallery. This intake is said to be 12 inches in diameter and is controlled by a gate valve.

During the early 90's, it developed that the sources of supply as above described were not capable of yielding a sufficient quantity of water to meet all the demands of the village. During the year 1896 the supply was augmented by drilling deep tubular wells into the underlying bed rock. An investigation of the first of these wells was made by a member of the State Board of Health acting as a committee, and was reported as producing a water of good quality from a sanitary point of view. It was, however, inferior to the water from the gravel deposits and from the river in that it was very much harder, and further, contained large quantities of incrusting constituents. On the basis of the report submitted, the source was approved by the Board, which action was embodied in the following letter under date of August 11, 1896:

"Mr. C. W. Wiles, *Superintendent Water Company, Delaware, Ohio.*

Dear Sir: The State Board of Health has considered your application for approval of an additional water supply for the city of Delaware, to be obtained from a deep well located about sixty feet west of the boiler house, and thirty-five feet north of the central well, and you are hereby notified that the same has been approved by the Board. Yours truly,

(Signed) C. O. Probst,
Secretary."

This first deep well was afterwards supplemented by four additional deep wells. It was also necessary to install air lift machinery for pumping the deep wells. The discharge from the air lift, as at present arranged, is permitted to flow into the large dug well.

The sources of supply as at present in use include the large dug well, the infiltration gallery, the direct intake, and the five deep wells. During the recent drought, the use of the river intake was avoided for meeting ordinary demands on the supply by pumping water with a portable centrifugal pump from the river on to the ground overlying the infiltration gallery, and thus materially increasing its yield. The arrangement was merely a temporary one, but it produced fairly good results as indicated by analysis.

Among the people of Delaware there has long existed a suspicion that the river intake was frequently opened. This suspicion was aroused by the frequent turbid condition of the water in the mains, a turbidity that closely resembled that of the water in the Olentangy River, and further, by occasional outbreaks of typhoid fever. During 1907 a series of examinations of the water delivered to consumers was made by the State Board of Health, with the result that very conclusive evidence was obtained showing that the river water was being pumped into the mains. The water company has stoutly maintained that the river intake has never been opened nor ordered to be opened by any officer connected with the water company. It was admitted, however, that the intake had been opened, but that this was either the result of accident or malicious intent upon the part of persons not connected with the water company. Nevertheless, the water company was not willing to agree to have the direct intake locked and the key placed in the custody of the health officer, as suggested by the State Board of Health, on the ground that such a procedure would be dangerous in case of a severe fire.

During 1908, the village engaged the services of The Riggs and Sherman Company of Toledo, consulting engineers, to make a thorough investigation of the condition of the public water supply with a view to determining a reasonable price to be paid by the city in case it wished to take over the water works, and what terms might fairly be imposed upon the water company in case the company was permitted to retain its franchise. As a result of the report submitted by the consulting engineers, the water company was constrained to make a number of improvements in the water works equipment, including the development of a more adequate source of supply.

The additional supply now proposed is to be derived from a series of tubular wells sunk in the gravel deposits of the bottom land and placed along the river bank. These wells will extend along about 1,500 feet of the river bank and will all be located upon land belonging to the water company. The total area of the land controlled by the water company is in the vicinity of 25 acres. The tubular wells will be about 4 inches in diameter and will in every case be sunk to the rock. On the end of each well will be placed a suitable strainer for preventing the entrance of fine material. It is not the intention, as might at first be supposed, to secure water by infiltration from the Olentangy River. The wells were placed in this position rather to intercept the ground water flow before it reaches the river. Various borings in the gravel deposits in different parts of the property owned by the water company, show that the surface of the bed rock has a general slope toward the southward, or in the direction of the proposed wells. It is, therefore, inferred that the flow of ground water will also be in this direction. The various wells are to be connected to two suction mains leading to the pumping station from the east and west, and each well connection will be provided with a valve whereby any well may be cut off or thrown in at will. At the end of each of these suction mains it is proposed to drill a deep rock well, similar to those already in use, which may be thrown in in case the wells in the gravel fail to yield a sufficient quantity of water. The deep wells will not be used under ordinary circumstances because of the excessive hardness of water derived from the greater depths. The new system of wells will be pumped directly by a large power pump, and it is expected to furnish the entire supply for all ordinary conditions of consumption. The old well and its tributary infiltration gallery will be retained as an emergency supply. It is also believed advisable as an additional precaution in case of fire, to retain in place the direct intake to the Olentangy River.

The location of the proposed wells is such that there can be no possibility of injurious contamination since there are no habitations or buildings other than the pumping station in the vicinity, and it was not deemed, therefore, that sanitary analyses of all of the wells would be essential in determining their fitness as sources of public supply. One sample was collected for one of the new wells and the analysis proved very satisfactory from a sanitary point of view, but the water was quite turbid due to insufficient pumping after driving the well. Should any of the wells contain an excessive amount of iron or incrusting constituents, it will be a simple matter to shut them off. It should be pointed out, however, that there is a possibility of contamination of the large dug well and perhaps several of the new wells near the pumping station, on account of the pumping station privy. This is very crudely constructed and the fecal matter is retained in a mere shallow excavation in the ground. Danger from this source can be obviated by providing watertight receptacles placed at or above the surface of the ground.

January 12, 1909, the Board approved the above proposed additional water supply, provided:

1. That the intake between the Olentangy River and the infiltration gallery be removed altogether or that a manhole be constructed about the controlling valve so as to make it readily accessible.

2. That (in case the river intake is maintained), the valve controlling same be locked and the key placed in the custody of the health officer. That in event of a severe fire or other great emergency, the water works officials be permitted to break the lock, but that in every such case immediate notification must be made to the health officer.

3. That the privy belonging to the pumping station be reconstructed in such manner that fecal matter cannot get on to or into the soil, and that it be maintained in a cleanly condition satisfactory to the health officer.

4. That no building other than the pumping station, nor any source of possible pollution be permitted within 500 feet of any well.

5. That the water company file with the State Board of Health as soon as same can be prepared, a set of plans showing the location of each of the new wells, the old dug well, the infiltration gallery, the direct intake, and the connections from each of these sources to the pumps.

March 18th, 1909, a letter was received from the health officer of Delaware, pointing out that these conditions of approval were not being met.

Delaware was visited by one of the engineers of the Board on March 31st, 1909, with a view to making an examination on the grounds. He reported as follows:

The Delaware Water Company has recently increased its supply of water by sinking a series of tubular wells in the gravel deposits near the existing water works and bordering on the Olentangy River. Thirteen wells were drilled though the original plans called for a greater number. It is believed, however, that the thirteen wells will furnish all the water that is necessary. Twelve of these wells derive their supply from the gravel deposits and extend only to the surface of the bed rock which is found at a depth of about 22 feet below the surface. The remaining well extends to a depth of 100 feet and derives its supply from the underlying rock under slight artesian pressure.

During the recent inspection it was found that conditions Nos. 3, 4, and 5 had been carried out in a satisfactory manner. Conditions Nos. 1 and 2, however, have not yet been fulfilled. In regard to the direct intake to the Olentangy River, the water company has offered the municipal authorities the privilege of reconstructing or removing same as called for in the conditions of approval of the supply quoted above, but requires on the other hand that the city shall assume the responsibility in case there is found to be a lack of supply in times of fire emergency. The city authorities refuse to take this responsibility and have notified the water company that the company must carry out the conditions imposed by the State Board of Health. This the water company does not seem inclined to do for the reason that the manhole arrangement required in condition No. 1 of the Board's approval entails considerable expense, nor does the water company wish to take the responsibility of closing the direct intake.

It is claimed by one of the company's consulting engineers, Mr. H. F. Dunham of New York, that the valve controlling the direct intake is in good condition and that a manhole would not greatly add to the ease with which it could be inspected and repaired. There can be no question, however, that with the direct intake arranged as at present, it is not possible to tell whether or not the valve is in perfect repair; and it would, therefore, seem necessary that some means be employed for making certain that river water is not entering the distribution pipes. The method for accomplishing this which would involve the least expense seems to be as follows:

Inasmuch as it is claimed by the water company that under ordinary conditions the entire supply can be drawn from the new wells, it would be no hardship on the water company to require that both the direct intake to the Olentangy River and also the valves controlling the entrance of water from the old well and infiltration gallery to the pumps be locked shut. This should be done by means of locks or possibly patent freight seals owned and placed by city officials. The patent freight seals would seem to be perhaps the cheaper and more effective and could readily be stamped with some device which could not be easily duplicated. In case it becomes necessary to use water from the large well, the locks or seals may be broken by the water works authorities, but in such event immediate notification should be made to the health officer.

At a meeting of the State Board of Health held April 22nd, 1909, this matter was considered, and in view of objections raised to complying with Conditions Nos. 1 and 2 of the Board's approval of January 12th, 1909, and that the new wells, according to the statement of the consulting engineer, were able to furnish twenty-four hours' supply in seventeen hours, the Board reconsidered its former action of approval and substituted the following condition in lieu of conditions Nos. 1 and 2 of said approval, namely:

That only the new additional supply shall be used under ordinary circumstances and when it becomes necessary to use any portion of the old supply, immediate notification thereof shall be made to the local health officer. In order that the public may be assured of the carrying out of this condition, the health officer shall be empowered to place locks or seals upon the valves admitting the old supply into the pumps; but the water company shall be permitted to break the locks, or seals, provided notification is made to the health officer or his authorized representative within a half hour after the same shall have been broken.

REPORT ON PROPOSED WATER SUPPLY FOR DELTA.

On April 30, 1909, a communication was received from The Riggs and Sherman Company of Toledo, consulting engineers for Delta, requesting approval of a proposed source of public water supply for that village. A representative of the engineering department visited Delta on May 4, 1909, for the purpose of obtaining a sample of the proposed supply and making an examination on the ground. The following report was submitted:

Delta is a village of about 2000 population in the southeastern part of Fulton County on a small tributary of the Maumee River known as Bad Creek. The area within the corporation limits is about 1.5 square miles. The general topography is flat except in the valley of Bad Creek which is about 20 to 30 feet below the general level and has rather steep sides. Delta is primarily a farming center though it contains one important industry, namely, a condensed milk factory which employs a large part of the population. The village has some municipal improvements including an electric lighting plant and paved streets. The system of sewers, however, is very imperfect.

Owing to the occurrence of several destructive fires in recent years, the village desires to install a public water supply which it is also intended to use for general domestic purposes. Until recently, water for general household use has been obtained from private drilled wells of which there are about 175 in all. These wells penetrate thick drift deposits of clay and hardpan and derive their supply from just above bed rock, from the same waterbearing stratum which is to be developed for the public supply. These wells yield a water of generally good quality from a sanitary point of view, though it is rather hard and contains an objectionable amount of iron.

Proposed Supply. The proposed public supply wells are located in the northern part of the village on rising ground to the eastward of the valley of Bad Creek. The property now owned by the village is four acres in area. The first well drilled penetrates the following formation:

Material.	*Thickness of Stratum.*	*Depth to Bottom of Stratum.*
Yellow sand	5 feet	5 feet
Yellow clay	7	12
Tough blue clay	100	112
Hardpan	3	115
Dry gravel yielding some gas	4	119
Hardpan	2	121
Shale in shattered condition, abundantly water-bearing	4	125
Soft shale	5	130
Compact shale	60	190
Gray slate	15	205
Black slate	10	215

The boring it is said remained perfectly dry until a depth of 121 feet was reached when water rose to within 41 feet of the surface. A second well was drilled to a depth of 240 feet and penetrated practically the same formation. The additional depth below the waterbearing stratum is for the purpose of providing adequate submergence of the air lift pipes.

A pumping test on well No. 1 indicated that it is capable of yielding something over 100,000 gallons per twenty-four hours. At this rate it is anticipated that three wells assisted by a reasonable amount of storage will meet all the demands of the village. The storage will consist of a receiving basin having a capacity of 159,000 gallons, into which the water will be pumped from the wells by air lift. On the distribution system there will also be placed an elevated tank having a capacity of 70,000 gallons.

It is expected that within one year after installation of the public supply about 750 persons will make use of same, representing a daily consumption (based on a consumption of 75 gallons per capita) of 56,250 gallons. It is believed that the contemplated present installation of mains, pumping mahinery, etc., will serve the village for a period of twenty years. Should the supply not prove sufficient to meet all needs, it is believed that it can be increased indefinitely by the drilling of additional wells.

Quality of Water. Though the first well which was drilled was pumped for a period of five days at the rate of 100,000 gallons per twenty-four hours, it failed to yield a water that was free from turbidity. The analyses indicate a water of good quality from a sanitary point of view, but one containing a large amount of total solids composed principally of mineral matter producing hardness of the water. The sample submitted also contains a large amount of iron which if not reduced by continued pumping will give rise to considerable complaint owing to discoloration of the water as drawn from taps, staining of plumbing fixtures and fabrics in the laundry. The probable quality of the water, after pumping has been continued for some time, is indicated by an analysis of a sample taken from a private well. This shows a water having very much the same characteristics as that obtained from the public supply well, but free from turbidity and sediment, and having considerably less iron. Even in the private well, however, the iron is sufficient to give rise to complaint and it would seem highly desirable if the village funds will permit, to build some form of deferrization plant.

At a meeting held June 16th, 1909, the State Board of Health approved this source of public water supply, as shown on the plans submitted by The Riggs and Sherman Company, on the following conditions:

1st. That before contracts are awarded, a full set of detailed plans in duplicate be submitted to and receive the approval of the State Board of Health; and,

2nd. That unless construction is begun before July 1st, 1910, this approval be considered void.

In accordance with the conditions above quoted, The Riggs and Sherman Company of Toledo, consulting engineers for the village, on June 28th, 1909, submitted complete plans and specifications of the proposed water supply. These were reported upon by the acting chief engineer as follows:

The plans comprise four sheets of drawings. The first is a map of the village and shows the distribution system. The second sheet is a general plan showing relative location of reservoirs, pumping station and wells; and also includes a detail showing method of piping wells. The third drawing shows details of construction of the pumping station and location of machinery. The fourth drawing shows details of construction of the collecting reservoir.

Briefly stated, the water works will comprise three tubular wells, a receiving reservoir, a pumping station, an elevated steel tank, and a distribution system. The wells, receiving reservoir, pumping station, and tank are all to be located on a tract of land four acres in area in the extreme northern part of the corporation and lying just to the eastward of North Street.

Wells. The three wells which have already been drilled, are, respectively, 215, 241, and 250 feet in depth. They are all 10 inches in diameter and are cased to rock. The water will be raised from the wells by means of air lift, the piping for which in each well will consist of a 2½-inch discharge pipe and a 1-inch air pipe. At the top of the well these pipes are enlarged to 4 inches and 2 inches in diameter, respectively. The water from each of the wells will be conveyed through the 4-inch pipe to the collecting reservoir.

Collecting Reservoir. The collecting reservoir which as already noted will receive the discharge from the air lifts, will also serve as a pump well for the high lift pumps. This reservoir is to be 20 feet in depth to the flow line and will have a diameter of 32 feet, thus giving it a total capacity of 120,000 gallons. The sides of the reservoir are to be constructed of brick and will have a thickness of 13 inches. The bottom will be constructed of concrete and will have a thickness of 12 inches. The water in the reservoir will be protected against contamination and the direct rays of the sun by a substantial frame superstructure. The suction leading to the pumps will leave the reservoir 6½ feet below the normal flow line or 13½ feet above the bottom of the reservoir. The end of the pipe will extend to within a few inches of the bottom and be provided with a suitable foot valve.

Pumping Station. The pumping station is to be a neat brick structure 42 feet by 30 feet in plan. A portion of the floor of the pumping station will be depressed 7 feet, thus forming a pit for the high lift pumps. The pumping equipment for immediate installation will consist of (1) an air compressor having a capacity of 250 cubic feet of free air per minute, which will furnish air for the air lifts in the wells; (2) a triplex power pump having a capacity of 720,000 gallons per twenty-four hours; and (3) a 50 horse power gas engine which will furnish power for driving both the air compressor and the triplex power pump. The transmission of power will be by means of belting. The pumping station is so arranged that the above described equipment may be duplicated when required. The pump as already noted will be placed in a depression in the floor so that it will have a suction lift varying from 0 to about 13 feet, depending on the elevation of water in the collecting reservoir.

Elevated Steel Tank. The elevated steel tank will have a total height to the flow line of 108 feet. The tank is to be 19 feet in diameter and 22 feet high in the straight and will have a hemispherical bottom, thus giving it a capacity of about 60,000 gallons. As the water works property is on about the highest land in the corporation, the elevated tank may be expected to maintain a pressure in the distribution system commensurate with its height, which (assuming that the water level in the tank will not be lowered more than 15 feet under ordinary conditions) will be from 40 pounds to 47 pounds per square inch.

Distribution System. The distribution system consists entirely of cast iron pipe with leaded joints. The mains vary in size from 4 inches to 10 inches. The present installation is so arranged that there will be no dead ends. The total length of mains contemplated for present installation is 5.4 miles divided as follows:

10-inch mains,	500 feet,	1.8 per cent.
8-inch mains,	4,050 feet,	14.2 per cent.
6-inch mains,	12,043 feet,	42.3 per cent.
4-inch mains,	11,870 feet,	41.7 per cent.

Fire protection will be afforded by 47 double nozzle fire hydrants. For purposes of repair, the distribution system will be provided with 100 cut-off valves divided as follows:

8-inch valves,	6
6-inch valves,	53
4-inch valves,	41

General Comment. In general the water works are well and substantially designed. There is nothing in connection with the handling of the water that can affect its sanitary quality. From the point of view of fire protection, it would be advisable to install duplicate pumping machinery and not use any mains of less diameter than 6 inches. However, it is not believed that the funds available will permit these improvements at the present time.

These plans were approved by the State Board of Health on August 2nd, 1909, with the previous condition; namely, "that unless construction is begun before July 1st, 1910, this approval be considered void."

Analyses of water from the proposed public supply wells made in the laboratory of the Board indicated the presence of an excessive amount of iron which would no doubt give rise to complaint on the part of consumers, due to the discoloration of the water as it was drawn from the tap and the staining of plumbing fixtures and fabrics in the laundry. The Board therefore strongly advised the authorities that, as soon as funds could be made available, the village install a suitable plant for removing the iron; that while such a plant might prove rather expensive as far as cost of construction was concerned, it would prove very economical in operation, as no additional machinery or help would be required.

REPORT ON SECOND PROPOSED LOCATION OF WATER SUPPLY INTAKE FOR HURON.

On January 18, 1909, there was received from Mr. J. Hermes, mayor of Huron, a communication requesting, on behalf of the village council, approval by the State Board of Health of a proposed water supply intake located in Lake Erie east of the easterly breakwater. Approval of plans for a proposed filtration plant, submitted on January 15, 1909, by Mr. J. E. Chapin of Canton, consulting engineer, was also requested. These filtration plans have been considered in a separate report. At a meeting of the State Board of Health on January 21, 1909, the matter of the location of proposed intake was referred to the chief engineer, and the following report was submitted:

The State Board of Health at a meeting held December 10, 1908, approved plans for the location of an intake some 1900 feet west of the westerly breakwater, with the understanding that the water was to be filtered in a manner satisfactory to said Board. At the same meeting at which the above action was taken, there were also considered requests for the approval of an intake to be located east of the easterly breakwater, and one to be located in the river above town. These last two locations, however, were not approved, although no definite action disapproving them was taken.

The communication from the mayor of Huron, above referred to, requests the approval of the easterly intake for the following reasons:

> "*First.* The lake front east of the pier is protected against wave action, while that west of the pier is constantly being washed away.
>
> *Second.* That no hauling for fuel will be required, saving ($300.00) three hundred dollars per year in operating expense compared with the west location.
>
> *Third.* That the plant building can be constructed for less expense on the east side."

The matter of approving the easterly location for an intake was investigated by the engineering department of the State Board of Health in December, 1908, and approval of such location was recommended to the Board at its meeting on December 10, 1908, together with approval of the westerly intake. The Board, however, approved only that portion of the report relating to the westerly intake.

It is usually believed that an intake located in Lake Erie a short distance east from any of the rivers which discharge into the lake is objectionable because the general movement of the water through the lake is from west to east. On the other hand, however, it should be considered that wind movements no matter from what direction, have the effect of producing currents, in the lake, entirely independent of the general or average movement from west to east. The records of the weather bureau show that at Cleveland the wind blows from a direction other than a westerly one for 57 percent of the time.

Referring specifically to the problem at Huron, the location proposed is several hundred feet east of the easterly breakwater and is well inside of a line drawn parallel to the shore and passing through the outer end of this breakwater. For this reason, it is believed that the intake located as proposed will not be affected by the Huron River water any more frequently than would the westerly intake which has been considered and approved by the Board. The easterly intake would, as it were, be located in a large pool of water which, it is believed, would be practically normal lake water. It is probable that the water from this location would be more turbid on account of wave action, but the turbidity would be caused by relatively heavy material and would not make the water any more difficult to purify at the proposed filtration plant.

February 6th, 1909, the State Board of Health approved the proposed intake for Huron, to be located in Lake Erie at a point approximately 600 feet east from the end of the easterly breakwater and 100 feet within the outer end of said breakwater, provided that detailed drawings showing the exact location and method of construction of the intake, and detailed plans for the intake well, be submitted to and receive the approval of the State Board of Health before the work is begun.

The authorities were also notified that it was understood that the action of the Board of December 10th, 1908, approving plans for the westerly location for the intake, was still valid, and that such westerly location might be used in case the village failed to make suitable arrangements with the railroad company for erecting the pumping station at the easterly location.

REPORT ON PROPOSED FILTRATION PLANT FOR HURON.

On January 15, 1909, Mr. L. E. Chapin of Canton, consulting engineer for Huron, submitted plans for proposed filtration plant for that village. The matter of proposed location for the intake was considered in a separate report. The plans were referred to the engineering department, and the following report was made:

As the matter of the location of the intake is not at the present time decided, the proposed plans for a filtration plant are so arranged that the plant may be used with either the easterly or westerly intake.

Briefly stated, the proposed works are to comprise a 12-inch cast iron intake extending approximately 1,000 feet into Lake Erie; an intake well or forebay located on the shore of the lake; a low service pump; a concrete coagulating basin; two gravity mechanical filters; and a clear well. The pumps, coagulating basin, clear well, and coagulating devices, are to be contained beneath one roof, which is also to contain a municipal electric light plant.

Intake. No detailed drawings are submitted, although the general locations of both proposed intakes are shown.

Intake Well or Forebay. No detailed drawings of this well are submitted.

Pumps. From the intake well or forebay, the raw water is to be lifted by a centrifugal pump and delivered through a 6-inch wrought iron pipe at the entrance to the coagulating basin. The height of water in the coagulating basin is to be regulated by a butterfly valve controlled by a float.

Coagulating Basin. The coagulating or sedimentation basin is to be of concrete construction and to comprise a rectangular tank 18 feet 3 inches wide, 35 feet long and 24 feet deep. The basin is to be divided into two equal compartments by a vertical concrete wall extending down the center of the basin so that the water will travel a distance of approximately 70 feet through the basin.

Filters. From the coagulating basin the water is to be carried by gravity through an 8-inch pipe and discharged on to the surface of the filters. The latter are two in number, each 18 feet 9 inches by 8 feet 9 inches wide. They are to be of reinforced concrete construction, but the plans do not call for monolithic construction. In the bottom of the filters are the collecting systems. The latter are to be composed of a central collector of 7-inch extra heavy galvanized iron pipe. Into this are to be tapped, at 6-inch intervals, $1\frac{1}{4}$-inch extra heavy wrought iron laterals; while into the laterals are to be tapped perforated brass strainers at 6-inch intervals. On top of the strainers are to be placed 12 inches of gravel composed of three layers of the following sizes: $\frac{3}{4}$-inch to $1\frac{1}{2}$-inch; $\frac{3}{8}$-inch to $\frac{3}{4}$-inch; and 3/16-inch to $\frac{3}{8}$-inch.

On top of the gravel is to be placed 30 inches of filter sand of an effective size from 0.35 to 0.45 m. m.

There is to be no form of agitation except that due to the wash water, for the removal of which a metallic gutter is to be provided down the center of the filter.

No loss of head gauges are provided nor auxiliary power to operate the filter valves. An open rate controller comprising a float valve and regulating orifice is to be provided on the discharge pipe from each filter.

Wash water is to be applied by a 6-inch connection to the force main which is a 10-inch cast iron pipe.

Clear Well. The clear well is contained beneath the filter house and is 33 feet long by 18 feet 9 inches wide by 13 feet deep. It is separated from the coagulating basin by a concrete wall.

Capacity. The filter plant as shown on plans is capable of purifying 900,000 or more gallons of water per day. This is an abundant supply for a village of the size of Huron. The large anticipated water consumption is doubtless due to the fact that the water will be used to a great extent for railroad and manufacturing purposes.

February 6th, 1909, the State Board of Health approved these plans for a proposed filtration plant, submitted January 15th, 1909, provided:

1st. That detailed plans of the distribution system of the water works be submitted to and receive the approval of the State Board of Health before being constructed;

2nd. That the 6-inch wash water pipe supplying the filters and also the manifold pipe or main collector be increased to at least 10 inches in diameter;

3rd. That the lines carrying the coagulated water from the sedimentation basin to the filters be enlarged and straightened so that a velocity therein, based on the nominal capacity of the plant, will not exceed 2 feet per second;

4th. That the clear well be increased in size or other storage be provided in standpipe or elsewhere, so that the total storage for filtered water will be at least 200,000 gallons.

5th. That the raw water pump be installed in duplicate.

REPORT ON PROPOSED IMPROVEMENT OF NATURAL FILTRATION SYSTEM AT IRONTON.

On March 24, 1909, there was received from Mr. C. H. Ketter, president of the board of public service of Ironton, a plan and description of proposed improvement of the infiltration system at that city. This plan was referred to the engineering department, and the following report was made:

During 1907 and 1908, there was installed at Ironton a system of wells located in the gravel bar above the city, with the intention of securing a natural filtration system. This system was installed, in a general way, in accordance with the plans approved by the State Board of Health on January 23, 1907, although certain features of the original plans were changed or omitted during construction. Chief among these omissions was a reservoir to provide storage of water for back flushing.

Owing to the impervious nature of the bar, which was not thoroughly tested preliminary to the installation of the infiltration system, it has been impossible during low stages of the river to obtain a sufficient quantity of filtered river water. To speak more in detail, there has been found a thin layer of hardpan in the gravel bar, a few feet below the surface but over the wells, which layer prevents the passage of river water down through the gravel. Consequently, the wells are usually fed only by limited quantities of ground water.

Proposed Improvement. In order to make it possible for sufficient quantities of river water to filter through the gravel to the wells, it is proposed to dredge, to a depth of about 8 feet, an area of the river approximately 25 feet wide and 750 feet long, the inner boundary of which is 10 feet outside the outer wells. The material thus dredged is to be washed and cleaned for the purpose of removing the above mentioned hardpan layer, and then replaced. In case the amount of clean material is insufficient to fill the excavation, new material of proper quality will be imported to make up the deficiency.

While it cannot be definitely stated that the proposed improvement will result in affording a satisfactory water in sufficient quantities, yet it is believed that such improvement is a step in the right direction, and that even though a bacteriologically safe water may not be obtained, a clear water will result; and such water may be more easily treated by a subsequent purification process than the raw river water.

April 1st, 1909, the State Board of Health considered this proposed improvement of the infiltration system at Ironton by "dredging and breaking up the hardpan outside the pure water well clusters in the Ohio River at Ironton, Ohio," as shown on plan and description submitted March 24th, 1909, and the plan was approved with the understanding that should the proposed improvement not result in securing a bacteriologically safe water, steps should be immediately taken toward further improving the supply.

REPORT ON PROPOSED WATER SUPPLY FOR LEWISBURG.

The matter of a proposed water supply for Lewisburg was first brought to the attention of the State Board of Health in July, 1908, when a request was made by Mr. Harry J. McDargh of Dayton, consulting engineer, for an examination by a representative of the State Board of Health of a site proposed as a location for water supply wells. In accordance with this request, one of the assistant engineers accompanied by the consulting engineer visited Lewisburg on July 16, 1908, and as a result of this visit the consulting engineer was informally advised that the site selected, which lay to the westward of the village, was satisfactory so far as its remoteness from possible sources of contamination was concerned. A well was accordingly sunk and a pumping test was made. The results of the pumping test were entirely unsatisfactory and the site was therefore abandoned. On September 5, 1908, a communication was received from Mr. C. W. Pontius, president of council, stating that the village had selected a new site for public supply wells. An informal communication was sent to Mr. Pontius, stating that while it was not possible to predict the action of the Board, the past policy had been to require that wells for a public supply be located so as to be at least 500 feet from any building and not subject to pollution by the underflow from nearby built up areas. Three wells were sunk on the site selected and samples were collected from one of them after a suitable pumping test. On January 4, 1909, one of the engineering assistants visited Lewisburg for the purpose of making an examination on the ground. The following report was submitted:

Lewisburg is a village with a population of about 750 and is located in the northeastern part of Preble County just west of Twin Creek, a tributary of the Great Miami River. The country to the west and north of the village is undulating. In the eastern portion of the village there is a rather steep slope toward Twin Creek. The entire drainage of the town is into Twin Creek.

The bed rock in the vicinity of Lewisburg is blue limestone which is one of the members of the Cincinnati group. The rock is covered in the higher portions of the town with drift of glacial origin varying in thickness from about 15 to 55 feet. The slopes of the valley of Twin Creek in the eastern portion of the village are formed by ledges of the Cincinnati limestone which are masked by drift deposits. The stream valley is filled to a depth of about 50 feet or more with drift material. The general slope of the bed rock is toward the westward so that it is not likely that a great amount of the underflow from the village finds its way into the drift deposits of the creek valley. A general section of the modified drift deposits in the vicinity of Lewisburg as given in the state geological reports, is as follows:

Material.	*Thickness of Stratum.*	*Depth to Bottom of Stratum.*
Soil	1½ ft.	1½ ft.
Yellow clay	10	11½
Blue clay	8	19½
Sand and gravel	35½	55

It was in the sand and gravel of these drift deposits to the westward of the village that a public water supply was first sought, but a test well failed to yield an adequate quantity of water.

The only data relative to the formation of the drift deposits in the valley are given by the well borings recently made in the search for a public water supply. These will be presented somewhat later.

Lewisburg seems to be a thriving small agricultural center, having no manufactures of any magnitude, and presents a generally clean and well kept appearance. As far as could be ascertained during a brief visit, the sanitary conditions are good. The vaults are generally carefully constructed of brick laid in Portland cement, or of concrete, and are presumably watertight or nearly so. Water for domestic uses is obtained from numerous private wells which derive their supply from sand and gravel deposits in the drift. Those wells which lie near the ridge overlooking the valley of Twin Creek, obtain their supply from rock which in this vicinity comes near the surface. While many of the wells are not suitably located relative to sources of possible contamination, there has been no indication that any of the private wells have at any time been responsible for the causation of water borne diseases.

The site chosen for the proposed public supply wells lies in the bottom lands of the valley of Twin Creek, about 800 feet to the eastward of the eastern corporation line and about opposite the central portion of the village. The land on which the village has an option for water supply purposes is about one and one-fourth acres in extent and lies just to the south of Clay Street near the intersection of this street with Dayton Street. The elevation of the site is about 100 feet below the greatest elevation within the corporation limits. Three tubular wells, each 6 inches in diameter, have been sunk to depths varying from 50 to

55 feet. The deepest reaches the underlying limestone bedrock. The formation penetrated is as follows: Clay to a depth of about 25 feet; then a stratum of waterbearing sand and gravel varying from fine at the top to coarse at the bottom; underlying this a stratum of blue boulder clay not over several feet in thickness which in turn is supported upon the bed rock. The surface of the water in the well stands at about 16¼ feet below the surface of the ground, an elevation which is said to be 2 feet and 10 inches below low water in the nearby creek. It is quite probable that some error was made in the measurements as it is not likely that the ground water in the creek valley will stand lower than the water in the creek itself. The only explanation of such a phenomenon, if it actually exists, is that the clay strata overlying the waterbearing sand and gravel stratum are so impervious as to perfectly separate the water in this stratum from the water in the creek. Such a condition of affairs would be very favorable to the quality of the water encountered in the wells. The pumping test on the wells was continued for a period of seven days during which a discharge was maintained at the rate of about 300 gallons per minute, which draft depressed the ground water level 5 feet. This lowering of the ground water level was reached soon after pumping and remained constant during the greater part of the test.

The location of the wells with respect to possible sources of contamination is not all that is desirable. To the eastward a distance of about 350 feet is a dwelling with accompanying privy and pigpen; at a distance of 450 feet is another dwelling with accompanying privy; and 750 feet distant are two stables. At a distance of about 450 feet to the east-northeastward is a flour mill with several accompanying outbuildings. At a distance of about 500 feet to the northwestward is a slaughter house, and beyond this is a cemetery. To the westward at distances of 1,000 to 1,200 feet are a creamery, tobacco warehouse, and a residence, all with one or more accompanying outbuildings. The wastes from the creamery and slaughter house are discharged into a small open watercourse which flows about 200 feet to the northward of the well. South of the wells there are no buildings, but about 500 feet distant a storm sewer discharges on to the low lands of the stream valley. The territory to the southward is devoted to farming and is usually planted with wheat.

The analyses of the water give no marked indication of objectionable contamination, but it is possible that with continuous pumping of large quantities there may take place a deterioration in the quality of the water due to pollution from some of the nearby buildings and habitations. The water is somewhat hard, though not excessively so for an Ohio ground water, and contains a small amount of incrusting constituents. The characteristic of the water which is most liable to give rise to complaint on the part of the water takers, is the iron content which is sufficient to cause staining of plumbing fixtures and fabrics in the laundry.

February 15th, 1909, the Board approved this proposed water supply, to be obtained from wells located on a lot about 1000 feet east of the easterly corporation limit and approximately one and one-fourth acres in area, on the southerly side of Clay Street just to the westward of its intersection with Dayton Street, provided:

1st. That if the water is found to deteriorate in quality, the supply be abandoned within one year after receipt of notice to that effect from the State Board of Health;

2nd. That the village secure control over sufficient land surrounding the wells to prevent the location of any buildings or other sources of possible contamination within a distance of at least 300 feet from the nearest well; and,

3rd. That the village council pass an ordinance prohibiting the existence within 500 feet of any public supply well, of pigpens, manure heaps, or deposits of refuse of any putrescible character whatsoever; and further, that all privies located within 500 feet of any public supply well be constructed and maintained in accordance with the accompanying set of rules and regulations.

The authorities were notified that this approval related only to the source of supply, and that before beginning construction it would be necessary to submit complete plans and specifications, showing the manner of development of the supply.

The Board also made the suggestion that the quality of the water for domestic purposes could be greatly improved by removing the excess of iron, and that it would be practicable to do this without great expense.

RULES FOR CONSTRUCTION AND MAINTENANCE OF PRIVIES.

1. All privies shall be provided with watertight receptacles resting at or above the surface of the ground and so placed that all fecal matter is discharged into them.

2. The receptacles in which fecal matter is contained shall be entirely enclosed in a suitable compartment under the seats, which will prevent the admission of flies but shall be so constructed as to be readily accessible for inspection and the removal of receptacles.

3. All seats shall be provided with hinged covers which will not remain open unless held open.

4. An ample supply of powdered slaked lime or dry loamy earth shall be accessible for sprinkling over the fecal matter after each use of the privy.

5. As soon as full, receptacles shall be emptied and the material removed at least one-fourth of a mile beyond the city limits and buried in the ground.

6. It shall be the duty of the health officer or his representatives to inspect all privies not less frequently than once in two months, and to prosecute persons found not complying with the above rules.

REPORT ON PROPOSED ADDITIONAL WATER SUPPLY FOR LOGAN.

A request having been made for an investigation of proposed additional water supply wells for Logan, one of the engineering assistants visited that village on August 13, 1909, made the necessary inspection and obtained samples of waters. The following report was submitted:

The existing water supply of Logan is obtained from two dug wells; one was installed with the approval of the State Board of Health in 1895, and the other was added in 1897 without being submitted to the Board for formal action. Both of these wells are located in the bottom land of the Hocking River on the opposite side of the stream from the village. The village owns for water purposes about one acre of land. The adjoining land is used for farming purposes only and there are no habitations within a distance of at least 500 feet of either well. The Hocking River flows to the northward of the village property and about 50 feet distant from the present wells. At ordinary stages, the water in the river is about 10 feet below the surface of the ground on the village property, but during times of flood the ground may be covered to a depth of 4 or 5 feet.

There are two proposed additional wells, both located on the water works property and drilled to a depth of approximately 134 feet. The formation penetrated could not be accurately ascertained but is about as follows:

	Depth of Stratum.	*Depth below Surface of Ground.*
Sandy clay	12 feet	12 feet
Gravel	30	42
White sand rock	25	67
Remainder	unknown.	

Salt water was encountered in the white sand rock, but this was effectually cased off. At the time of examination, the new drilled well near the east property line was pumped at a moderate rate for about one hour, and a sample was collected directly in the containers. For comparison a sample was also taken from dug well No. 2 and from a tap on the mains.

It would appear that the water is of good quality from a sanitary point of view, and in point of hardness and iron content is somewhat superior to the existing supply. In both waters, however, there is sufficient iron present to cause staining of plumbing fixtures and some turbidity and sediment in the water as it is drawn from taps, but this does not seem to meet with popular disapproval.

On September 9th, 1909, the State Board of Health approved this additional water supply for Logan, to be obtained from two drilled wells located on the water works property, upon the following conditions:

1st. That the tops of the wells be so constructed as to effectually prevent the entrance of flood waters;

2nd. That all salt water or water otherwise of objectionable quality be shut out by suitable casings; and,

3rd. That this approval be considered void if the wells are not completed and in use by September 1st, 1910.

REPORT ON PROPOSED ADDITIONS TO WATER WORKS AND PROPOSED SEWAGE PURIFICATION PLANT FOR THE HOME OF THE OHIO SOLDIERS, SAILORS, MARINES, THEIR WIVES, MOTHERS AND ARMY NURSES, AT MADISON, LAKE COUNTY.

The Home of the Ohio Soldiers, Sailors, Marines, Their Wives, Mothers and Army Nurses, is located at Madison, Lake County, about one mile north of the Lake Shore Railroad station and three and one-half miles south of Lake Erie. The Home is now strictly a state institution, although it was formerly supported by the Women's Relief Corps.

The present population of the institution is about sixty-five. A remodeled cottage when fully occupied will increase this number to about one hundred. A further increase in the population of the institution will be dependent on legislative action, not only as to funds but also as to requirements for admission.

Water for drinking purposes is obtained from a driven well, whence it is pumped to storage tanks located in the upper story of the main building. Water for laundry purposes is obtained from cisterns into which flows rain water from one-half of the roof of the main building.

The sewerage system of the Home consists of a line of 6-inch vitrified sewer pipe which extends due north to an open cesspool located some 250 feet from the main building. The overflow from this cesspool flows into a small ditch located near the northerly boundary of the state's land.

This crude method of disposing of the sewage of the Home has long been unsatisfactory. In 1905 the State Board of Health investigated conditions and recommended that a sewage purification plant be installed as soon as possible. No action was taken by the board of managers until the fall of 1908 when engineering advice was obtained looking to the construction of a sewage purification plant.

On July 6th, 1909, plans were received from The Riggs and Sherman Company of Toledo, consulting engineers, for the enlargement of the present water works and for a proposed sewage purification plant for the Home. These plans were referred to the engineering department and a report made, based upon the investigation in October, 1905, and an inspection at the institution by one of the Board's engineers on July 2nd, 1909.

PROPOSED ADDITIONS TO WATER WORKS.

The improvements in the present water works comprise the erection of a tank and tower to be used in connection with the existing well and pumping plant. The entire project shown on the plans includes a new well and pump house and an elevated water tower of 20,000 gallons capacity, but owing to a lack of funds the board of managers will, for the present, be able to complete only a part of the improvements as above indicated.

The plans for proposed additions to the water works, submitted by The Riggs and Sherman Company, were approved by the State Board of Health July 15th, 1909.

PROPOSED SEWAGE PURIFICATION PLANT.

The plans for proposed sewage purification comprise a settling tank, dosing tank, two intermittent sand filters and a sludge filter. The settling tank is shown at a distance of about 420 feet north of the main building, and the intermittent sand filters some 120 feet still farther north.

The sedimentation tank and dosing tank are combined in one concrete structure, circular in plan. The settling tank portion is the annular space surrounding the central circular space, which latter is to be used as the dosing tank. The annular space used as the sedimentation tank is shown with the capacity of 7950 gallons which, based on a per capita flow of 30 gallons, would represent a period of flow of about sixty-four hours.

The dosing tank is designed for a capacity of 1560 gallons, which represents a flow of approximately twelve hours. Automatic alternating siphons are planned to discharge the contents of this chamber on to the sand filters.

The filters as shown on the plans are to have a total area of about 2100 square feet, or roughly 0.1 acre. This would represent a rate of filtration of 30,000 gallons per day, using as a basis a sewage flow of 30 gallons per capita, or would be equivalent to an acre for each 1000 population tributary. The filtering material is to consist of lake sand 2 feet in thickness supported on a 12-inch layer of graded gravel ranging in size from $\frac{1}{4}$ to $\frac{1}{2}$-inch. Each bed is to be suitably underdrained by means of vitrified tile. The main effluent drains are to discharge into a ditch extending along the north side of the state's property, and thence in a northeasterly direction to a small stream which ultimately flows into Lake Erie.

The plans as described above were approved by the Board July 15, 1909, subject to the following conditions:

1st. That a small screen chamber, satisfactory to the State Board of Health, be placed on the main sewer before the sewage enters the sedimentation tank.

2nd. That the combined settling tank and dosing tank be reduced to a total period of flow of twenty-four hours based on a population of 100 and a water consumption of 30 gallons per capita.

3rd. That detailed drawings of the dosing devices be submitted to the State Board of Health for approval before the plant is built.

4th. That the depth of sand in the filters be increased to 3 feet, thus making the total depth of filtering material 4 feet.

5th. That the underdrains to the filters be made of vitrified tile pipe.

6th. That the filters be located as far north on the state's land as practical. That samples of the filtering material for the sand filters be submitted to the State Board of Health for approval.

8th. That this approval be void after August 1, 1911, unless construction shall have been begun before that date.

On July 26, 1909, The Riggs and Sherman Company was notified that the plan for automatic dosing apparatus consisting of two 5-inch Miller alternating siphons, submitted in accordance with the 3rd condition of approval, was satisfactory.

Owing to the impracticability on account of lack of funds of constructing the sewage purification plant according to the plans originally submitted, the consulting engineers requested approval for an entirely new arrangement, which arrangement was informally discussed by letter between the engineering department and the consulting engineers. The revised plans, submitted July 20, 1909, were reported on essentially as follows:

In accordance with the first condition of approval of the original plans, the revised plans show a screen chamber which is satisfactory in design and which is placed at the entrance to the sedimentation tank.

The sedimentation tank and dosing chamber are essentially the same in design as shown on the first plans, though they have been reduced in capacity in accordance with the 2nd condition of approval. The revised sedimentation basin has a period of flow of 32 hours based on a flow of sewage of 30 gallons per capita. While this capacity is somewhat larger than that prescribed in the conditions of approval, it will nevertheless prove satisfactory.

The intermittent sand filters have been removed considerably to the north, and for the lake sand originally specified it is proposed to substitute the natural soil found in the vicinity. This material is of a very fine sandy character and also contains a small amount of clay. It is not especially adapted for sewage purification purposes. However, in view of the fact that the area is to be exactly doubled over that originally intended, it is believed that the low rate of filtration will permit satisfacory results to be obtained.

The filter beds as shown on the revised plans are to be constructed by leveling and surrounding same with suitable embankments and the placing of underdrains at a depth of 4 feet. The laying of the underdrains is accomplished by excavating trenches to the proper depth, placing the drains and surrounding same with graded gravel to facilitate drainage, and then replacing the soil to the original level.

The revised plans were considered by the Board and were approved August 2, 1909, provided:

1st. That an area of 0.2 acre be provided for the intermittent sand filters.

2nd. That the authorities of the Home agree to increase the filtering area of the intermittent sand filters, when in the opinion of the State Board of Health this may become necessary.

3rd. That the underdrains be surrounded by material graded from fine to coarse to prevent clogging.

4th. That the beds be divided into four units of two groups each, each group to be supplied by one siphon from the dosing chamber.

5th. That the condition embodied in the Board's previous action, namely, that this approval be void after August 1, 1911, if construction is not begun before that date, be reaffirmed.

Subsequently, plans were received showing changes called for in the above conditions of approval.

REPORT ON PROPOSED WATER SUPPLY FOR PLEASANT HILL.

On June 2, 1909, plans for a proposed water supply for the village of Pleasant Hill were submitted by Dr. A. J. Bausman, member of the board of trustees of public affairs, and Mr. A. C. Reed, village engineer. These plans were reviewed by the engineering department and the following report was submitted:

Pleasant Hill is a village of about 600 population in the western part of Miami County on the Stillwater River. The village is a farming center and has no manufacturing industries. The area within the corporation limits is about one-half square mile. The surrounding country is rather level excepting in the valley of the Stillwater River. The surface of the stream is about 80 to 100 feet below the general level, and the valley is from one-fourth to one-half mile wide. Pleasant Hill is located on the brow of the ridge overlooking the valley on the eastern side of the river. The built up portion of the village is clustered about the intersection at right angles of the two main streets and covers about ten acres. As yet the village has practically no municipal improvements other than a short stretch of paved street.

Water for general domestic purposes has hitherto been principally derived from private drilled wells varying in depth from 20 to 70 or 80 feet. These wells penetrate about 4 feet of surface soil and then enter a porous waterbearing limestone. The porosity of the limestone offers abundant opportunity for pollution to travel considerable distances underground. Privy vaults are of course in general use and these are for the most part crudely constructed and often located dangerously near wells. It is probable that the above conditions have in the past been the cause of typhoid fever.

Beginning four or five years ago, there was considerable agitation for the introduction of a public water supply and a system of sewers, the former being desired primarily for fire protection while the latter was intended to improve sanitary conditions. This agitation resulted during the early part of 1908 in a popular vote for a bond issue of $18,000. This sum was expected to cover the installation of both water supply and sewerage, but as will be seen from the cost estimates further on, this sum will be no more than sufficient to cover the cost of the installation of the water supply alone.

The matter of a public water supply for Pleasant Hill was first brought to the attention of the State Board of Health in February, 1908, just previous to the vote on the bond issue, when a representative of the engineering department visited that village and addressed a mass meeting on the advantages of a public water supply and sewerage. Subsequent visits were made in October, 1908, and in April, 1909. The first of these visits was for the purpose of investigating several springs proposed as sources of supply and was followed by letters of informal advice against the use of these springs and the methods proposed for developing same. More recently, acting upon a suggestion of the State Board of Health, a test well was drilled in the valley of the Stillwater River, and it was in connection with an examination of this well that the second of the above mentioned visits was made. A supply to be derived from wells in the vicinity of this test well is that for which approval is requested.

Proposed Source of Supply. The proposed wells are located near the bank of the Stillwater River in the western part of the village. The village has an option on a strip of land extending along the river bank, 150 feet wide and as long as may be deemed necessary for the location of the wells. To date, two 8-inch wells have been drilled about 465 feet apart. The test well above mentioned (which will not be used as a part of the supply), is about midway between these two. Sections of the several wells are as follows:

Material.	*Thickness of Stratum.*	*Depth to Bottom of Stratum.*
Easterly Well —		
Yellow clay	33 feet	33 feet
Blue clay	8	41
Waterbearing gravel	6	47
Test Well —		
Yellow clay	10	10
Gravel	0 2 inches.	10 approx.
Blue clay	24	34
Waterbearing gravel	16	50
Westerly Well —		
Yellow clay	11	11
Gravel	27	38
Blue clay	12	50
Waterbearing gravel	18	68

It will be observed that a large gravel deposit was encountered in the westerly well, which appears in the test well as but a thin seam and which does not appear at all in the easterly well. This gravel is said to be waterbearing but probably would not furnish a sufficient yield after being pumped for some length of time to warrant its development as a portion of the supply, and it will therefore be cased off. The lower gravel stratum as far as can be learned, seems to be fairly continuous and it is believed will yield a sufficient quantity of water. Underlying the lower gravel is a dense limestone which apparently is not waterbearing. The water in the wells at time of examination rose to about 2 feet above the surface of the water in the nearby river, but it is said that the water in the wells does not fluctuate with the rise and fall of the river. The quantity of water that may be derived from the wells has not yet been definitely determined, though pumping tests are about to be made. From indications obtained from pumping the test well, it is estimated that each of the other wells will yield about 100 gallons per minute, or approximately 145,000 gallons per twenty-four hours. With three wells, there would therefore be a total yield of about 435,000 gallons per twenty-four hours.

There will be no sources of possible contamination near the site of the wells. At present about 150 feet distant is a tobacco barn, and about 100 feet distant there is a small boat house, both of which will be removed before the water works are placed in operation. About 600 feet distant is a dwelling, but this is sufficiently removed so that it will probably not affect the water in the public supply wells. Considerable apprehension is felt in regard to a cemetery about 1,800 feet distant and to the eastward. This cemetery, however, is not located in the drift deposits of the river valley but on the sides of the valley, over rock having a shallow covering of earth. Furthermore, the configuration of the valley is such that water reaching the public supply wells would come from the northward rather than the eastward, in which latter direction the cemetery is located. Further, it would not seem possible that any contamination, even supposing it could find its way through the rock and hence through the drift deposits, would reach the wells without being thoroughly purified.

Quality of Water. Analysis of a sample of water from the test well has been made in the laboratories of the State Board of Health, and the results show a water of highly satisfactory quality from a sanitary point of view and also free from objectionable physical characteristics. There is sufficient iron present to cause perhaps a slight staining and discoloration of water in dead ends, but this will probably not give rise to complaint. The water is comparatively soft for this locality, and further, contains no incrusting constituents. In this latter respect, the water is more satisfactory than that derived from some of the springs first proposed as sources of supply.

Pumping Station and Machinery. The pumping station is to be a small brick structure 18 feet wide and 25 feet long, inside dimensions, with a pump pit depressed about 5 feet below the present level of the ground. The pumping equipment will consist of one 32 horse power gasoline engine and a triplex power pump having a nominal capacity of 435,000 gallons per twenty-four hours. The make of machinery has not been decided upon. Room is available in the pumping station for a duplication of this machinery. The pump will be equipped with a revolution counter and vacuum and pressure gauges. It is intended that when in operation complete daily pumping records will be maintained.

Distribution System. The distribution system will consist of the following:

8-inch pipe,	150	feet.
6-inch pipe,	6,000	feet.
4-inch pipe,	9,000	feet.

All pipe will be of cast iron in 6-foot lengths and will be laid with so-called universal joints. This type of pipe was chosen because of its cheapness and because it is said to be less subject to electrolytic action from nearby trolley lines. (It may be noted that an interurban trolley line passes through the village.) It is recognized that there is a much larger proportion of 4-inch pipe than is desirable, but this is necessary because of insufficiency of funds. Fire protection will be afforded by 20 fire hydrants representing 7 per mile of main. This number is somewhat below the average. The distribution system will be equipped with 14 cut-off valves or about 5 per mile of main, which is somewhat above the average. Within one year after installation, it is anticipated that about 100 taps to the distribution system will be made.

Elevated Tank. Partial storage and equalization of pressure will be afforded by an elevated steel tank 18 feet in diameter and 20 feet 4 inches high in the straight; the bottom of the tank has the form of a hemispherical bowl and the total capacity to the flow line is about 50,000 gallons. The flow line is about 120 feet above the surface of the ground throughout the main portion of the village, and about 200 feet above the pumps. The storage capacity afforded by the elevated tank will permit the following use of fire streams, assuming each stream to deliver 200 gallons per minute:

4 fire streams	1⅔ hours.
3 fire streams	2¾ hours.
2 fire streams	6⅓ hours.
1 fire stream	indefinitely.

Owing to the small size of pipe, however, it will be possible to use more than two fire streams in the central part of the town only.

Cost. The estimated cost of the water works may be itemized as follows:

Four acres of land with water rights, @ $200 per acre	$800
Three wells, @ $150 each	450
Pumping station and foundation	2,200
Gas engine	850
Triplex power pump	550
Accessories to pumping machinery	100
Distribution system	8,000
Elevated tank	3,100
Engineering and contingencies, 10 per cent. of above	1,600
	$17,650

The above represents a cost per capita of about $29.40. This is a moderately high figure, but local difficulties offer a sufficient explanation therefor.

At a meeting held June 16th, 1909, the State Board of Health considered these plans for a public water supply for Pleasant Hill, submitted on June 2nd, 1909, by Dr. A. J. Bausman, member of the board of trustees of public affairs, and Mr. A. C. Reed, village engineer, said supply to be derived from wells located in the valley of Stillwater River to the westward of the village, on a strip of land owned by the village, 150 feet wide and bordering the river bank. The plans were approved provided:

1st. That before construction is begun, it be demonstrated by suitable pumping tests that the wells can yield a sufficient quantity of water to meet all demands; and,

2nd. That this approval be void after July 1st, 1910, if the water works have not been completed by that date.

REPORT ON PROPOSED NEW WATER SUPPLY FOR PORTSMOUTH.

The city of Portsmouth, the county seat of Scioto County, is in the southern part of Ohio at the junction of the Scioto and Ohio rivers. Its population is estimated at 22,000.

HISTORICAL.

The water works were installed in 1871. The plant was located at a point then well above local pollution, but at present nearly opposite the center of the city. The supply was taken directly from the Ohio River. The plant comprised a pumping station and distribution system; no storage reservoir was provided.

CONDITIONS REQUIRING PURIFICATION.

The conditions requiring the purification of the Portsmouth water supply are well shown in a report of the chief engineer of the State Board of Health, who visited Portsmouth March 6, 1905. In this report is shown that there has been a rapid development of the city in an easterly direction upstream, so that there is now much pollution entering the river, principally from industrial plants within a few miles of the intake of the water works. Moreover, the growth of the city requires that sanitary sewers discharge into the stream, and the question of further approval of such sewers will probably arise.

Not only is the river water dangerously polluted at Portsmouth by the wastes of the city itself, but the city of Ironton, having an estimated population of about 15,000, is but twenty-seven miles above the intake. All of the sewage of this city is discharged directly into the river. There is also a small village, Sciotoville, on the river six miles above Portsmouth, and there is considerable pollution by surface washing at this point.

The quality of the river water at Portsmouth was investigated by the State Board of Health in 1901. In this report it is stated that the river has a watershed above Portsmouth of 61,170 square miles, on which there is a population (in 1900) of 1,710,000, equivalent to 28 per square mile. Not only is the river shown to be subject to dangerous pollution at Portsmouth, but it is always so turbid that it is objectionable for domestic and industrial purposes and at times contains very large quantities of silt.

Typhoid Statistics. The public water supply is in general use and its effect on the health of the community is shown by the typhoid statistics presented in the following table. The quality of the water is gradually depreciating, as is shown by the increase in the death rate in recent years.

ANNUAL DEATH RATE FROM TYPHOID FEVER IN PORTSMOUTH.

Year.	*Estimated Population.*	*Actual Number of Deaths.*	*Rate per 100,000 Living Population.*
1895	15,500	10	65
1896	16,000	11	69
1897	16,500	10	61
1898	17,000	9	53
1899	17,500	8	46
1900	18,000	11	61
1901	18,500	10	54
1902	19,000	13	69
1903	19,500	18	93
1904	20,000	16	80
1905	22,000	16	73
1906	24,000	11	46
1907	24,000	18	75

Summary of Engineer's Report of 1905. The engineer's report concludes with the following:

> "1st. It is decidedly necessary to the health and welfare of Portsmouth that a pure water supply be provided.
>
> 2nd. The most practicable method of providing such a supply would be to filter the Ohio River water.
>
> 3rd. The intake for the water works should be carefully designed with reference to preventing clogging and should be placed above the influence of local pollution."

APPOINTMENT OF SPECIAL WATER COMMISSION.

In the spring of 1905 the city council appointed a special water commission of representative citizens to make studies and recommendations in regard to water works improvements. This commission is without legal power but the council has agreed to adopt whatever plans it recommends.

In the fall of 1905 a special election was held for the purpose of voting on a bond issue to build a mechanical filter plant for the purification of the Portsmouth water supply. This bond issue was lost by a small number of votes.

One of the acts of the water commission was to get an expression from the State Board of Health relative to the continued use of the present intake were a filter plant provided. At a meeting of the Board on June 19, 1906, it was decided that plans for a filter plant located in the center of the city and drawing water through the present intake would not be approved by the Board.

TESTS PREVIOUS TO JULY 10, 1908.

At the request of the water works commission, several inspections have been made at Portsmouth by the State Board of Health relative to proposed means for obtaining an improved supply. It has been suggested that it would be very desirable to employ a consulting engineer to advise particularly with reference to the desirability of all available sources of supply, but the commission is of the opinion that an engineer is not necessary until a source has been selected. They state that it is their intention to employ a competent man to draw up finished plans for water works, but to conduct preliminary investigations themselves.

Inspection of July 26, 1906. On July 26, 1906, one of the Board's engineers visited Portsmouth to discuss with the commission the various projects in view for a new supply. The commissioners expressed themselves as desirous, for economical reasons, of obtaining a supply in a manner similar to that used at Gallipolis, Ohio, or Owensboro, Kentucky. The commission was advised by the Board that before action could be taken on such a proposition it would be necessary to make thorough tests both of the quality and of the quantity of water that could be obtained in such a manner; also that such tests should cover both high and low stages of the river. The tests at high stage were necessary to show that the required purification could be obtained, and those at low stage to obtain information relative to the source of water, as to whether or not ground water was obtained under such conditions.

Tests of Bonanza Bar. Following the above recommendations, a concrete well, 5 feet in diameter, was sunk in the Bonanza bar opposite the center of the city. During the inspection of July 26, 1906, and also subsequently by correspondence, the attention of the commission was called to the probability of pollution of water from this source, due to obtaining a contaminated ground water. The bar is probably underlaid with a seamy limestone, which affords a direct passage of water from the various vaults and other possible sources of pollution in the city.

On August 5, 1907, a sample was collected from this well by the health officer and shipped to the laboratory of the Board. The evidence indicates that the water obtained was of unsatisfactory quality both from a chemical and bacteriological standpoint. In a letter of August 13, 1907, the commission was advised "that the water from the test well is derived from the land side and that it is distinctly unfit for a public water supply." It was also advised that a more suitable site be obtained. No further tests of this bar were made.

TESTS OF TYGART BAR.

Across the river and about half a mile above the Bonanza bar on the West Virginia side is another natural deposit called Tygart bar. This extends from a point about 500 feet below the mouth of Tygart Creek to over 1,500 feet above the stream. Its width is variable but near the creek is approximately 500 feet. The surface material composing the bar is of sand grading from about 0.2 m. m. near the shore to 0.3 m. m. at 400 feet from the shore. The deposit is said to be 17.5 feet deep and of nearly uniform thickness. The size of the material increases with the depth below the surface to a fine gravel at 6 feet below, where the largest particles are about $\frac{3}{4}$ inch in diameter. Before conducting extensive tests of the quantity of water available in this bar, a procedure involving considerable expense, preliminary tests of the quality of the water were made by sinking small vertical wells in the sand.

Examination of October 29-30, 1907. At the request of the water commissioners, one of the assistant engineers of the Board visited Portsmouth on October 29, 1907, to examine the experimental plant which had previously been placed in the bar; also to collect samples to determine the quality of the water obtained.

It was found that two wells had been driven into the Tygart bar at a point 200 feet from the shore and 500 feet above the mouth of Tygart Creek. The larger well consisted of a 10-inch casing, 10 feet 8 inches long, driven into the sand about 5 feet. The lower 4 feet of the casing was perforated with $\frac{1}{4}$-inch holes about $1\frac{1}{2}$ inch apart. It was found that the sand immediately about the casing had been drawn into the well through the perforations, so that the river water entered the well direct without purification. For this reason no samples were taken.

The second and smaller well was 2 inches in diameter and consisted of an ordinary wellpoint driven to a depth of 4.5 feet into the sand. The lower end was provided with a gauze strainer, about 2 feet long. consisting of meshes of gauze about 20 or 30 to the inch. The submergence of the top of the strainer was about 2.5 feet.

A sample was taken from this small well on October 30th, after two hours' pumping at a rate of approximately 8 gallons per minute.

To replace the well first described, a third well was sunk on the afternoon of October 29th. This well consisted of a $10\frac{3}{8}$-inch casing, 10 feet $2\frac{1}{2}$ inches long and open at the bottom. It was sunk 5 feet 8 inches into the sand. It was noted that the sand inside the casing was 2 feet 1 inch below the sand outside the casing. The depth of water near the well was 2 feet 9 inches.

Water was pumped from this well from 3:00 P. M., October 29th, until 10:00 A. M., October 30th, when a sample was taken.

The rate of pumping was 11.4 gallons per minute.

After pumping had ceased, measurements were taken to show the rise of water in the well. These are shown in the following table:

Depth Below Surface of River.	*Rise, Feet per Minute.*
3.0 feet.	
2.4	.109
2.0	.093
1.4	.075
1.0	.047

The temperature of the air at the time of sampling from the above wells was 49° F.; of the river water, 52°; and of the water in the 10-inch well, 60°.

The analyses of the samples taken on October 29th and 30th, 1907, indicate that the supply obtained from the Tygart bar was of satisfactory quality for domestic use. The evidence indicates that the water consisted very largely of ground water and not of filtered river water. The samples from the two wells were similar.

Previous to this examination, samples collected by the health officer from the first 8-inch well described above were received at the laboratory on October 23rd. These analyses indicate that the conditions at the time of sampling were similar to those of the examination of October 29-30, 1908. The water obtained from the well was of satisfactory quality, but its chemical content indicates that it was a ground water and that it was not obtained by filtering river water.

As these tests indicated that a water of satisfactory quality could be obtained from the Tygart bar, more extensive tests as regards quantity were next undertaken.

Examination of July 10, 1908. At the request of the water commission, one of the assistant engineers visited Portsmouth on July 10, 1908. It was learned that two 16-foot lengths of Cook strainers, 8 inches in diameter, were laid horizontally at right angles to the current of the river at a depth approximately 6 feet below the surface of the sand and at a point near that at which the former tests had been made. These strainers were placed by dredging the necessary material and afterwards replacing it. To this strainer was attached a suction of a duplex steam pump. The water end of the pump was 12 inches, its stroke 9 inches, and its usual velocity 28 revolutions per minute. Previous to sampling on July 10th, water had been pumped continuously for twenty-four hours at a rate of approximately 325 gallons per minute (allowing 33 per cent slippage). It was stated that the water cleared fifteen minutes after pumping was commenced.

During excavation for the strainers, it was learned that there was a deposit of gravel beneath the surface of the sand and that the size of the sand increased with the depth. In back filling, the finer material was placed around the pipe and the coarser material at the top of the trench.

The stage of the river on July 10th, as registered on the Portsmouth gauge, was 7 feet. The depth of the water directly over the strainer was 6.5 feet.

During the examination, the river was rising. Its temperature was 82° F., while the temperature of the air was 88° F.; the temperature of the water from the well was 78°. Two samples were taken, one from the river near the well and the other from the discharge of the pump.

Examination of September 11, 1908. A second examination of the plant as described above was made at the request of the water commission by the Board's engineer on September 11, 1908. The plant and methods of operation were similar at this time to that described under the examination of July 10, 1908.

The Ohio River on September 11th was at a very low stage, 2 feet 8 inches as indicated by the gauge at Portsmouth. It was stated that the water was lower than it had been for over three years and that the stage was lower than obtains except under abnormal conditions. A considerable area of the Tygart bar was exposed and the water line was about 250 feet from the outer edge of the bar. The material immediately over the strainer was exposed.

Previous to sampling on September 11th, the pump had been operated at about 30 revolutions per minute for about twenty-four hours.

Duplicate bacterial samples were collected from the discharge of the pump; also one chemical sample. Chemical and bacterial samples were also collected from the river. It was also stated that it would be desirable to make further studies relative to the probable source of the water obtained, for which purpose chemical samples for alkalinity were collected on September 12th.

Results of Analyses of Samples Taken July 10th and September 11th. During both examinations the water of the Ohio River was turbid, generally polluted, and very unsatisfactory for domestic and industrial purposes.

There is a notable variation in the quality of the water obtained from the strainer. Sample No. 7427, received October 23, 1907, indicates a ground water of satisfactory quality. Sample No. 7631, collected July 10, 1908, also indicates a water of satisfactory quality, and the evidence indicates that the water obtained consisted more largely of filtered river water. It will be noted, however, that the physical properties of the water were only fair as indicated by the distinct sediment and the turbidity and color. It is possible that the turbidity and sediment may have resulted from the precipitation of iron of which the water contained 0.9 part per million. From a sanitary standpoint the water is satisfactory. Sample No. 7912, collected September 11, 1908, indicates a much less satisfactory water. Its organic content is high (due possibly to oil), and the bacterial and physical examinations indicate a poor degree of purification. The hardness determinations indicate that the greater part of the water obtained was from the river.

The bacterial counts shown on the well water were from plates made at the pump, while the sample of water from the river was plated on the following morning. The samples from the well were also plated the following morning and contained an average number of 1,800 bacteria per cubic centimeter, a number greater than that of the river. The plates poured at the pump to determine the number of bacteria in the river water were partially destroyed during transportation, but they indicated not more than 500 bacteria per c. c. in the river. These results indicate little removal of bacteria.

Examination of Samples by J. W. Ellms of Cincinnati. Following the examination of July 10, 1908, a letter was written to the chairman of the water commission, advising him that the water collected from the bar on July 10th was of satisfactory quality for domestic use; that the bacterial removal accomplished, however, was low. It was recommended that further examinations be made by a responsible chemist, and following this recommendation, on three occasions samples have been sent to J. W. Ellms of Cincinnati. In all instances these samples were collected after twenty-four hours' operation of the pump at about 30 revolutions per minute. The samples were shipped in small containers, packed in a box of ice, and as stated by Mr. Ellms, the method of transportation was not very satisfactory.

The results of these examinations are shown in the following table. The evidence indicates considerable variation in the quality of the water from the bar from a sanitary standpoint. On July 27th the filtered water had a large number of bacteria and coli were present in 5 c. c. On August 20th the number of bacteria in the filtered water was greater than that in the river but coli were absent in 5 c. c. of the filtered water. On September 3rd the total bacterial content of the filtered water was low but coli were present in 1.0 c. c. It should be stated, however, that the examinations for coli consisted of presumptive tests only, lactose bile media being used.

PROPOSED WATER SUPPLY AT PORTSMOUTH.

EXAMINATIONS BY J. W. ELLMS.

Date.	Source.	Bact. per c. c.	Coli.	
			c. c. Used.	Results.
1908				
7/27	River	5,400	0.5.	+
7/27	Tygart bar	2,700	1.0	0
			5.0	+
8/20	River	100	5.0	+
8/20	Tygart bar	375	5.0	0
9/1	Tygart bar	135	1.0	+

NOTE: Coli tests are presumptive only, using bile media.

SUMMARY OF TESTS OF TYGART BAR.

One of the most interesting features of the examinations of the water from the Tygart bar is that the source of the water obtained has apparently changed with a continued use of the experimental plant. The first samples taken from the small wells indicate a ground water, as does also the first sample taken from the experimental strainer. The second sample indicates a larger percentage of river water, while the last sample taken on September 11th indicates that the majority of the water obtained was from the river. These results are readily explained from the fact that there is always present a certain quantity of ground water in the bar and that continued pumping exhausts this supply which is replaced by filtered river water.

It is also significant that the more recent examinations indicate a comparatively poor reduction of bacteria. This is contrary to experience at other plants but may be explained by the fact that there has been an erosion of the material over the end of the strainer which extends farthest into the stream. During the examinations, the barge carrying the pump has been anchored close to the strainer and on this account there has been a scouring action beneath the barge one side of which has rested on the bar. It is thought that the results accomplished are not representative of the best efficiencies that may be obtained under more satisfactory conditions.

CONCLUSIONS.

The water commissioners are very desirous of obtaining an expression of opinion from the Board as to whether or not they will approve the installation of an infiltration plant in the Tygart bar along lines similar to those used in constructing the Owensboro, Kentucky, plant. They are at present under heavy expense and request an opinion as soon as possible.

While the experiments at Portsmouth have not shown a high degree of purification, they have at least demonstrated that the water from such a plant is probably not from ground sources but is filtered river water. In regard to the results that may be accomplished, it should be remembered that following the early installation of the Owensboro plant the results accomplished during a period of perhaps six months were not satisfactory. These poor results were due to improper covering of some of the strainer units. This condition is also probably responsible for the poor results accomplished at Portsmouth. With continued use of the Owensboro plant, there has resulted a very satisfactory water supply. Conditions at Portsmouth are similar to those at Owensboro, and it is thought that satisfactory results may be obtained with continued operation of the plant.

Another feature to be considered is the fact that were such a plant installed and poor results accomplished, it will be impossible to provide further purification devices which would accomplish satisfactory results at a less cost than would be required to purify the river water direct.

At a meeting of the State Board of Health held October 20th, 1908, the general plan of obtaining a new water supply for Portsmouth from the Tygart bar located about three-fourths of a mile above the city, was approved, provided:

1st. That a filtration plant of a design satisfactory to the State Board of Health be immediately installed whenever the water obtained from the Tygart bar shall be deemed unsafe by said Board;

2nd. That detailed plans showing method of obtaining the water, together with all features of the new water works, be submitted to and receive the approval of the State Board of Health before work is commenced; and,

3rd. That the new works be designed and constructed under the supervision of a competent engineer experienced in matters relating to water purification.

In compliance with condition 2, quoted above, detailed plans of new water works, prepared by Mr. Samuel M. Gray of Providence, R. I., consulting engineer, were submitted April 14th, 1909. These plans were referred to the engineering department and reported upon as follows:

The plans now before the Board provide for an entirely new pumping station, to be located on the edge of the river directly opposite Tygart bar and about 3,000 feet above the present water works.

Immediately under the engine room floor is to be a pump well 58 feet deep, in which are to be located the water cylinders of the pumping engines. The bottom of the well is 6 feet above low water in the river.

Extending from the pump well to the river bank, a distance of 150 feet, near the bottom of the well, is a brick tunnel through which extend three intake pipes. Two of these pipes are 18 inches in diameter and are the suction mains for the proposed infiltration system. The third pipe, 30 inches in diameter, is for a direct intake in case such intake is necessary in the future.

The two 18-inch suction mains are to be laid parallel, some 6 feet apart and a few feet below the bed of the river. They are to extend across to the Tygart bar on the Kentucky side a distance of some 1,200 feet. Here each line makes a turn of 90 degrees and extends up-stream a distance of about 900 feet, gradually decreasing in diameter from 16 inches to 8 inches. These last lines or carrier pipes are 76½ feet apart.

The carrier pipes are to be laid at least 5 feet below the surface of the bar and each line is to contain 55 brass strainer pipes spaced about 14 feet apart. Each strainer pipe extends 16 feet on either side of the carrier and enters the same at right angles. Each carrier pipe is to have a gradual slope toward the 18-inch suction lines.

The plans provide for underdraining a total area of 1.2 acres of the bar. It is believed that this area will supply 3,600,000 gallons per day, which is sufficient water for the present needs of the city. The estimate of the consulting engineer as to the capacity of the plant, is 6,000,000 gallons per day. The strainers have been placed at a depth at which it is believed principally river water will be obtained rather than ground water. If, however, it is found that the ground water in undesirable quantities should enter the system and cause deposits in the pipe or for any other reason the system should not furnish a safe and satisfactory supply of water, a mechanical filter plant can be readily installed on land adjacent to the pumping station, and the installation of such a plant is covered by the first condition of approval given October 20th, 1909. At the pumping station the piping is so arranged that the infiltration system can be back flushed. Water for this purpose will be supplied by a covered reservoir to be located 202 feet above the pumping station.

At a meeting of the State Board of Health, held April 22nd, 1909, these detailed plans for the pumping plant and natural filtration system for Portsmouth, submitted April 14th, 1909, by the board of public service, and prepared by Mr. Samuel M. Gray of Providence, R. I., were approved, provided:

That the plans for the covered reservoir, which is to store water for back flushing, be submitted to the State Board of Health for approval before the same is installed.

It was also recommended to the authorities, in order to facilitate back flushing and thus prolong the life of the system at Portsmouth,

(a) That the strainer pipes be surrounded by coarse gravel;

(b) That each strainer pipe consist of two portions, the portion nearer the main carrier being 6 inches in diameter and the outer portion 4½ inches; and

(c) That the strainers be tapped into the main carrier on opposite sides on a "staggered" plan instead of arranging to have the two strainer pipes enter the carrier directly opposite each other.

Their attention was also called to the fact that conditions Nos. 1 and 2 of the approval of October 20th, 1908, were still in force.

On May 3rd, 1909, there were received from Mr. Samuel M. Gray, the consulting engineer, detailed plans of a covered reservoir, in compliance with the condition of approval given April 22nd, 1909. These plans were referred to the engineering department and reported upon as follows:

The proposed reservoir is to be circular in plan, constructed of concrete, 90 feet in diameter and 42 feet high, having a capacity of about 2,000,000 gallons. It is to be covered with a tile roof. It is to be located on Timmons Hill and connected with the pumping station by a 24-inch main.

This reservoir will afford ample storage of water for back flushing and will also supply the city during periods when the infiltration system is being back flushed.

These plans were approved by the State Board of Health May 20th, 1909.

REPORT ON PROPOSED LOCATION OF WATER SUPPLY INTAKE FOR PUT-IN-BAY.

On April 1, 1909, there was received from Mr. Charles E. DeWitt of Port Clinton, consulting engineer for Put-in-Bay, a general plan showing the location of intake proposed for water supply for that village. This plan was referred to the engineering department, and the following report was made:

Past investigations by the State Board of Health covering some twelve years, have fully demonstrated the unsanitary conditions at Put-in-Bay due to inadequate water supply and improper disposal of sewage.

On January 23, 1907, plans for proposed sewerage for Put-in-Bay were disapproved "unless all existing water supply intakes on the northerly side of the island be abandoned and the supply for the corporation be taken from an intake to be located on the southeasterly side of the island at a point to be approved by the State Board of Health.

"If the water drawn from this intake is used without filtration, it will be necessary to locate the intake at a much greater distance from shore than would be necessary if the water were filtered before delivering to consumers."

The proposed plan contemplates locating the intake on the southeasterly side of the island opposite the harbor where the boat landings are located and into which the sewage is discharged. The nearest possible source of contamination to the water of the proposed intake would be the bathing beach, some 2,000 feet north. The possibility of contamination from this source is, however, remote.

It is proposed to locate the intake at a point 100 feet from shore in 8 feet of water with rock bottom. Farther out the lake would have a clay or mud bottom. On account of the rocky bluff which forms the shore line near the intake, it is not likely that this portion of the shore would be used for bathing.

Owing to the small tax duplicate of the village of Put-in-Bay, it is possible to raise only $8,000 at the present time for the new water works. With this sum it is proposed not only to construct the intake but to install a pumping plant and distribution system. The consulting engineer urges that the village be permitted to proceed with the plan as shown on the drawing submitted, and that if any changes are desired by the State Board of Health, such as the farther extension of the intake or the purification of the water, the carrying out of these changes be postponed until later. On account of the small sum available, full details will not be decided upon until bids are taken.

In view of the difficulty which has been experienced during the last several years in trying to induce the officials of Put-in-Bay to improve sanitary conditions, it is believed that the present plan should be approved, although it may be desirable to install a filtration plant later. Under any circumstances, the proposed plan would greatly reduce the sanitary dangers which now exist in the village and to which all visitors are subjected.

This proposed location for intake for water supply for Put-in-Bay, on the southeasterly side of the island, as shown on the drawing submitted by Mr. Charles E. DeWitt on April 1, 1909, was approved by the Board on April 13th, 1909, provided:

1st. That in case the quality of the water after investigation by the State Board of Health should not prove to be satisfactory, the intake be extended farther into the lake or purification works be installed.

2nd. That full detailed plans showing the construction of the intake and the pumping station, be submitted to and receive the approval of the State Board of Health before same are constructed.

REPORT ON PROPOSED WATER SUPPLY FOR ST. HENRY.

The attention of the State Board of Health was first called to the proposed public water supply for St. Henry by a letter from the then consulting engineer, Mr. G. L. McKibben of Van Wert. The matter was referred to the engineering department for investigation. Shortly thereafter, Mr. McKibben was succeeded by Mr. Paul R. Murray of New Philadelphia, consulting engineer, and subsequent negotiations were conducted through him. A visit of inspection was made to St. Henry by one of the engineering assistants on November 17, 1908. A second visit was made January 14, 1909, for the purpose of obtaining additional water samples and collecting additional data. Besides the above, two informal conferences were held with the consulting engineer during November and December, 1908, and on February 10, 1909, an informal conference was held with Mr. W. H. Romer, clerk of council, and Mr. J. J. Moeller, member of council. The following report was submitted:

General Considerations. St. Henry is located in the south-central portion of Mercer County on the Wabash watershed. The nearest perennial stream to St. Henry is the south branch of the Wabash River, which flows in a westerly direction about three miles to the southwestward. The present population of St. Henry, as estimated from the last United States census report, is about 700, and it is said that the growth is slow. The area of the village within the corporation limits is about one-third square mile. The topography of the village and surrounding country may be described as gently undulating. The main drainage of the area within the corporation is toward the westward, whence it is carried off by drainage ditches to the southward. Some of the drainage finds its way directly to the southward, and a portion also goes to the northward toward Grand Reservoir.

St. Henry is primarily an agricultural center, though it contains a few manufacturing industries including the Pioneer Canning Company, the St. Henry Glove Company, and the Bimel Handle Company. None of these industries employs over twenty men. The village as a whole has a cleanly and well kept appearance, though public improvements such as street paving and the like are lacking. The only sewers consist of a few storm water drains in the main street, which receive only surface drainage, and as yet no wastes of a sanitary character. Privies are still in general use throughout the village and are ordinarily constructed with vaults or barrels imbedded in the ground. It is understood that the local authorities generally insist on the frequent cleaning of privies, so that they rarely constitute a public nuisance. On the other hand, but little attention is given to the watertightness of vaults or other receptacles, and it is presumable that the soil is more or less contaminated in their vicinity. A few residences in the village have been equipped with modern plumbing and use cesspools. These cesspools usually have an overflow outlet which discharges into a sort of blind drain composed of gravel and sand.

St. Henry is located within the area of glacial drift which, in this vicinity, has a thickness of 80 to 90 feet and consists of an impervious tenacious blue clay here and there interstratified with pockets of sand or mixed sand and gravel. The clay nearest the surface has a yellow color, due to oxidation of iron. The underlying bed rock is the Niagara limestone which in this vicinity seems to be quite porous near its upper surface and abundantly waterbearing. Within the village a few of the private wells, about a dozen in all, are dug to but shallow depths and obtain their supply from one or the other of the interstratified sand and gravel deposits. The greater number of private wells, estimated at 18 or 20 in all, are drilled to the underlying bed rock and tap the water therein contained. It is said that in drilling for rock water the bore of the well remains practically dry (so dry, in fact, that it is necessary to obtain water for drilling purposes from some neighboring well or cistern), until the rock is encountered, when immediately the water rises under pressure to within 20 feet of the surface of the ground. This condition, of course, obtains only where no waterbearing stratum of sand or gravel is encountered. It would, therefore, seem that the rock water is amply protected against surface contamination percolating down through the soil, unless there prove to be points where gravel or sand deposits occur throughout practically the whole depth of the drift.

Proposed Water Supply. The village population is very anxious to obtain more adequate fire protection and to this end have bonded themselves up to the legal limit, which, in the case of St. Henry, amounts to $13,000. This it is recognized is scarcely sufficient to build a water works capable of affording the most complete fire protection, yet it is proposed to make the money reach as far as possible and leave the completion and improvement of the system to future years.

The first site suggested for the proposed public supply wells is a plot of ground (part of which is already village property) near the center of the built up portion of the village. It is located on the east side of Sycamore Street about 185 feet north of Main Street. The village fire department building is built on that portion of the lot belonging to the municipality, and it was proposed to drill a well about 10 feet to the northward of this building, erecting an addition to the building to serve as a pumping station, and to secure for the purpose the adjoining lot to the northward. Each of the two lots has a frontage of 66½ feet and depths of 140 feet and 250 feet, respectively. Site A is in a thickly built up portion of the town and is in the proximity of numerous privies, stables, chicken yards, and other objectionable surroundings. The nearest privy to the proposed location is 75 feet distant. While the district to the immediate northward is not thickly built up, yet the likelihood of future growth in this vicinity is greater than in any other part of the village.

Owing to the proximity of site A to sources of possible contamination, the consulting engineer was informally advised that it would hardly be possible to recommend this site for the approval of the State Board of Health. Thereupon four additional sites were suggested as possible locations for public supply wells and these are designated as B, C, D, and E. After a conference with the consulting engineer, it appeared that site D was on the whole the most satisfactory, as it is farther removed from the built up portion of the village than any of the other sites proposed, and further, is in a locality not likely to be built up in the near future. This site, as will be noted, is just northwest of the intersection of Washington Street and the Cincinnati Northern Railroad. The only possible sources of pollution in this vicinity are three privy vaults about 250 feet to the southwestward. Subsequent developments indicated the fact that the expense of developing site D was not within the limits of the means of the village, and B and C were suggested as the next most available. E was thrown out because expensive to develop and also because it is located in a low lying portion of the village which receives the surface and other drainage from considerable of the surrounding territory. Site B was next ruled out because it was found that the property could be secured only by means of condemnation proceedings.

Site C which is practically in the same locality as site B, but on the opposite side of Sycamore Street, seems at the present time the most available. It is about 350 feet north of site A measured between the nearest property lines. The lot at site C upon which an option is now held, has a frontage on Sycamore Street of 130 feet and a frontage on Washington Street of 150 feet. This property can be obtained for $350. It is also believed that a lot to the northward of equal size can be obtained at a nominal figure, and it is understood that the village is willing to purchase same as soon as its funds will permit. The territory to the northward, northeastward, and northwestward is entirely free from possible sources of pollution within 600 feet. At about this distance to the northwestward is a canning factory, which very likely during its periods of operation accumulates large quantities of putrescible material on the surface of surrounding land. It is not believed, however, that this material will deleteriously affect the quality of the ground water, due to the protection afforded by the impervious strata of clay. To the southward the conditions are somewhat less favorable, there being four privies within 300 feet of the lot line, the nearest of which is but 100 feet distant. It is possible, however, that by locating the wells near the northern edge of the property that the distance from the nearest privy can be made at least 250 feet.

In order to ascertain the possible effect of contamination from surface sources on the quality of the ground water derived from the limestone, a number of samples were taken from deep wells in various parts of the village. The chemical analyses indicate all of these waters to be of the same character and very closely alike. They are very hard as is generally the case with rock waters in this part of the state, and the high incrusting constituents render the water almost unusable for boiler purposes. The iron while varying somewhat, is present in all the waters in sufficient quantities to cause marked discoloration, turbidity, and sediment. In a public water supply, iron in this amount would likely give rise to considerable popular complaint. There are no indications in the chemical content which can be taken as significant of the sanitary quality. The most important indications are observed in the variations of the bacterial content, as it is noticeable that the highest numbers of bacteria were found in the waters from those wells located nearest possible sources of surface contamination. The conclusion might seem plainly evident, therefore, that the deep seated water in the rock is affected by surface conditions, but some doubt is cast upon this conclusion by the fact that the wells showing highest bacterial content have the tops of their casings surrounded by shallow pits 4 or 5 feet in depth and of about equal diameter, which pits may possibly become full of water to the level of the top of the casing, with the result that some of this water overflows into the casing itself. The water contained in these pits consists of waste water from the pumps and is naturally contaminated to a greater or less degree. It is not certain, however, that the samples collected were contaminated in this manner, but the possibility suggests conservatism in interpreting the results of the analyses unfavorably. In the case of site C, however, the greatest danger is not from surface sources, but rather from the possibility that after the introduction of the public supply it might be found convenient to use some of the existing private drilled wells as receptacles for sanitary sewage, which is a danger that should be carefully guarded against where the public supply is derived from so porous a stratum as that found in the limestone underlying St. Henry.

March 1st, 1909, the Board approved, for a proposed public water supply for St. Henry, the territory located at the northwest corner of Washington and Sycamore streets and including a plot of land 130 feet wide in a north and south direction and 150 feet long in an east and west direction provided:

1st. That the quality of the water after test wells are driven and pumped, be satisfactory to the State Board of Health;

2nd. That if at any time the quality of the water, in the opinion of the State Board of Health, so deteriorates as to be a menace to the health of the water takers, the village shall agree to secure a new source of supply farther removed from possible sources of contamination.

3rd. That the approval be not considered in effect until the village council shall have passed an ordinance, first, strictly forbidding the use of any abandoned well as a receptacle for disposing of any waste matters whatsoever; second, requiring all privies within 500 feet of any public supply well to be constructed in accordance with rules and regulations prescribed by the State Board of Health, and third, requiring that all cesspools within 500 feet of any public supply well be made absolutely watertight. Further, that a certified copy of this ordinance be filed with the State Board of Health before the water works are placed in operation.

4th. That full detailed drawings and specifications showing the proposed method of developing the public supply and delivering same to consumers, be submitted to the State Board of Health before construction work is commenced.

5th. That this approval be valid only until January 1st, 1910.

SUPPLEMENTARY REPORT ON PROPOSED WATER SUPPLY FOR SWANTON.

On February 2, 1909, there were received from Mr. George Champe of Toledo, consulting engineer for Swanton, detailed plans showing the proposed method of developing the public water supply and also copy of an ordinance recently passed by the village council for the purpose of protecting said supply. These plans and the ordinance were referred to the engineering department, and the following report was made:

On September 23, 1908, the State Board of Health approved certain territory in Swanton as a source of ground water supply, with the following conditions:

> "1st. That samples of the water be submitted to the State Board of Health for analysis at regular intervals of not greater than six months.
>
> 2nd. That the council pass an ordinance prohibiting the use of any abandoned wells in the village for the purpose of disposing of domestic wastes, and providing for the abolition of cesspools and the reconstruction and maintenance of privies within 500 feet of the public supply wells, in accordance with suggested list of rules and regulations appended.
>
> 3rd. That if in the opinion of the State Board of Health the public water supply becomes so contaminated as to be dangerous to health, the village shall seek a new supply.
>
> 4th. That detailed plans showing the method of developing the supply be submitted to and receive the approval of the State Board of Health."

The present plans and copy of ordinance are submitted in order to comply with conditions Nos. 2 and 4 of the Board's approval.

The detailed plans indicate that provision is made for pumping one of the three wells only, namely, No. 2, in the northwest corner of the water works property; this well having been found under test to give the most satisfactory yield, which amounted to about 70,000 gallons per twenty-four hours with continuous pumping.

Pumping is to be effected by an electrically driven deep well pump having its water cylinder at a depth of 76 feet below the surface of the ground. This is the depth at which it was found during the test pumping of the well that the greatest available quantity of water could be secured. The pump is to have a capacity of 30 gallons per minute, or a daily capacity of 43,200 gallons, against a head of 200 feet. The electric motor is a direct current machine and has a capacity of 4 kw. at 220 volts. The pump and motor are housed in a small brick building 12 feet long and 10 feet wide, inside dimensions. For equalization of pressure and storage of water for fire emergency, an elevated wooden tank having a capacity of 30,000 gallons is provided. The tank is supported on a steel tower 100 feet in height which is sufficient to give good fire pressure throughout the village. To avoid possible contamination of the water by birds, the tank should be covered with a substantially constructed roof.

The mains of the distribution system vary in size from 6 inches to 10 inches. This, it may be noted, is a more liberal provision than is afforded in most small towns, yet adequate fire protection requires that no mains smaller than 6 inches be used.

It should be pointed out that additional fire protection may be obtained by the development of the deep seated water in well No. 1. This water would be available in great quantity if pumped by air lift. Owing to the presence of large quantities of objectionable mineral matter in the water, it is not fit for domestic purposes but would be entirely satisfactory for fire emergency and unobjectionable if turned into the mains, because the mineral content is not injurious to health but simply affects the taste of the water.

In order to comply with condition No. 2, quoted above, the village council has passed an ordinance which is drawn up along lines suggested to the local authorities by the State Board of Health at the time of the original approval of the source of supply.

On March 2nd, 1909, the State Board of Health approved these detailed plans and the ordinance for the protection of the water supply, and the authorities were advised that it would be desirable to place a roof on the elevated tank for protection against contamination by birds, and the suggestion was made that additional fire protection might be obtained through the development of the deep seated water in well No. 1.

REPORT ON PROPOSED NEW WATER SUPPLY FOR URBANA.

On August 19, 1909, the State Board of Health was informed that the city of Urbana was contemplating a new public water supply to be built and owned by the municipality and to take the place of an existing privately owned supply. On August 23, 1909, the acting chief engineer visited Urbana for the purpose of making the necessary inspection and obtaining a sample of the water. The following report which embodies the results of this investigation, relates only to the proposed source of supply and not to the method of developing same:

Urbana is a city with a population of about 7,000, located in the central part of Champaign County of which it is the county seat. The city has been for a number of years supplied with water by a private company, the supply being derived from dug and driven wells in the southwestern portion of the corporation. It is the desire of the municipality to own its own water works, but since the water company and the city authorities have been unable to agree upon a purchase price for the existing works, it has been decided by the authorities to construct an entire new system.

As previous investigations by the State Board of Health seem to indicate that the general ground water flow is toward the southwestward and that the public supply wells are more or less affected by contamination from the built up portion of the city, it was deemed advisable by the authorities in seeking a new supply to go in the opposite direction. Accordingly, a site was selected in the northeastern part of the city just east of the line of the Pennsylvania Railroad and south of Bloomfield Avenue. In this locality is a large open field having an approximate area of ten acres. This open field is surrounded by habitations and other buildings, but the territory to the northeastward and northward is but sparsely built upon. It is claimed also that the city is not likely to develop in this direction. In respect to location the proposed site is not altogether favorable, yet it is believed that wells can be so placed as to be fully 400 feet from the nearest building.

Two test wells have been sunk which exhibit the following formations:

Test well No. 1. Clays and hardpan to a depth of 20 feet; below this to a depth of 62 feet was found alternating strata of coarse sand and gravel, all of which are waterbearing.

Test well No. 2. This well shows a formation similar to that encountered in well No. 1, only the surface stratum of clay and hardpan is but 10 feet in thickness. Total depth of well No. 2, 78 feet.

Both wells have been pumped by means of air lift and show a large yield of water, although the yield has not been measured. At the time of inspection, the air lift was probably discharging in the neighborhood of 200,000 gallons per twenty-four hours. This pumping had been continued for some time without any apparent diminution in the quantity of water that could be obtained. Unfortunately, no measurements were taken of the variation of the ground water level during pumping. The question of quantity of water available must, therefore, be considered as not entirely settled, and before the proposition can receive final approval, additional pumping tests should be conducted.

The sample of the water submitted to the laboratories of the State Board of Health for analysis, proved entirely satisfactory. The chemical content with the exception of rather high nitrates, would indicate a water having a high degree of purity from a sanitary point of view. The water is moderately hard and contains some incrusting constituents. However, in this respect it is more satisfactory than the existing supply. The number of bacteria obtained from plates poured in the field was but 58 per cubic centimeter. The colon bacillus was not found present in a 10 cubic centimeter portion. There is a possibility of course that when the wells are pumped at a high rate continuously, as would be the case should they be used as a source of public supply, there would be a tendency to draw in contamination from considerable distances. On the other hand, the water is derived from extensive gravel and sand deposits, and as has been shown by repeated experience in this state, such deposits form a very efficient purifying medium. It is believed that if the wells, which are to be used as a source of public supply, are located on the site proposed but not nearer than say 400 feet from the nearest building or other source of possible contamination, no apprehension need be felt as to the continued good quality of the water.

September 15th, 1909, the State Board of Health approved the site proposed as a location for public water supply wells for the city of Urbana lying just to the eastward of the Pennsylvania Railroad tracks and to the southward of Bloomfield Avenue, upon the following conditions:

1st. That sufficient land be owned or controlled by the city so that no well used as a source of public supply will be nearer than 400 feet to any building, habitation, or other possible source of contamination;

2nd. That before construction is begun on the water works plant, the quantity of water available be ascertained so far as this is feasible by means of thorough pumping tests, which tests shall be conducted in a manner satisfactory to the engineer of the State Board of Health;

3rd. That before any contracts are let for the construction of the water works, complete plans and specifications of the water works system be submitted to and receive the approval of the State Board of Health; and,

4th. That this approval be considered void unless the complete plans and specifications above referred to are submitted not later than January 1st, 1910.

REPORT ON ADDITIONAL WATER SUPPLY FOR WILLOUGHBY.

Early in 1908 it became evident to the village authorities of Willoughby that the public water supply then in use was of poor sanitary and physical quality, and they therefore engaged the services of J. C. Ward, C. E., to suggest a plan for improving the supply. Somewhat later the services of the engineer were dispensed with and the village proceeded with the development of the supply without expert advice. Through a misunderstanding of the law on the part of the local authorities, the proposed new supply was not submitted to the State Board of Health for approval. On August 18th, 1908, the assistant engineer visited Willoughby and found the new works partly constructed. The local authorities were thereupon informally advised of the probable inefficiency of the works as designed and it was suggested that only a portion of the proposed plant be built for experimental purposes. The village authorities, however, considered it advisable to build the complete plant as originally designed. On the completion of the plant in February, 1909, a test was made of the quality of the water. This test not being satisfactory, it was followed by another in May, 1909. A complete description of the water works, outlining changes, etc., has been already prepared in connection with the general examination of the public water supplies throughout the state, and the following report merely deals with the essential features of the proposed supply and its operation:

The original public water supply of Willoughby was drawn from a brick infiltration gallery laid along the north bank of the east branch of the Chagrin River near its confluence with the main stream. This supply in time proved insufficient to meet the demands of the village and it became necessary to draw larger and larger quantities of water directly from the stream. While the stream is not grossly polluted, it is subjected, as in the case of all unprotected streams, to more or less intermittent pollution and as a matter of fact the colon bacillus is frequently found in analyses of the water.

Owing to the objectionable turbidities of the raw river water, which occur very frequently, and also the unsanitary qualities above referred to, an additional supply of better quality was determined upon. Mr. J. C. Ward, the consulting engineer for the village, recommended mechanical filtration of the river water inasmuch as no ground water supplies of sufficient quantity could be found. The cost of mechanical filters, however, proved more than the funds available would permit and an alternative was thereupon suggested by the consulting engineer. This alternative consisted in the installation of a so-called natural filtration scheme consisting of well strainers laid horizontally in the gravel beds of the stream bottom and 4 to 5 feet below the surface. Such a system has been in use at Owensboro, Kentucky, and is apparently giving good results, and according to the consulting engineer seemed a feasible proposition for Willoughby.

Before the consulting engineer, however, had time to develop his plans, his services were dispensed with and the board of trustees of public affairs proceeded to install a system in accordance with its own ideas. It seems that the board misunderstood the essential requirement of the system proposed by the consulting engineer, namely, that the strainers should be located in such extensive beds of gravel that they might intercept the underflow of the stream rather than draw by means of filtration from the water in the stream directly above the strainers. Instead of placing the strainer system in an extensive bed of gravel already pointed out by the consulting engineer which lay to one side of the main stream, the local authorities decided that "more live" water might be obtained by locating the strainer system under the main channel. It happened, however, that at this point there was but a very thin bed of gravel, to remedy which an excavation 108 feet long, 20 feet wide, and 5 feet deep was made in the underlying hardpan. Transversely across the bottom of this excavation were placed Cook strainers on 5-foot centers. These strainers in turn were connected with a cast iron header leading to an existing collecting reservoir or well which is also connected with the old infiltration gallery and the direct intake. Over the strainers in the excavation was placed sand and gravel obtained from the bed of the stream, to a depth of 5 or 6 feet. It is understood that this material was roughly graded so that coarse gravel surrounded the strainers.

It will be seen from the above that the new source of supply is in effect a crudely constructed slow sand filter having a filtering material of very poor grade and being without any means for the control of the process of filtration or for cleaning the filtering material. As a very liberal estimate, such a filter may be operated at the rate of 2,000,000 gallons per acre per day and produce a good effluent, but under actual conditions it is operated at a rate of from 4¼ to 8¾ million gallons per acre per day.

On the occasion of the first test in February, 1909, it was found impossible to obtain samples from the strainer system without a mixture of water from the old infiltration well. The results therefore could not be taken as indicative of the efficiency of the new supply but did show that the water being furnished the consumers was merely clarified river water and that but very little bacterial reduction was effected.

Before the time of the second test, arrangements were made whereby samples from the strainer system could be obtained direct.

During the latter test, samples were taken with the pump running at three different speeds; namely, the minimum which would obtain under ordinary operation conditions, the average which would obtain, and the maximum which might occur during a fire. These rates represented respectively, 4.35, 8.73, and 13.7 million gallons per acre per day. The results in the second test, as in the first test, indicated that the water was merely being clarified and not being purified. The bacterial reduction was so slight as to hardly be considered a reduction at all; in fact, in several instances there was a slight increase in the bacterial content. At all times during the second test the colon bacilius was found in the raw water and regularly appeared in the filtered water in about the same size portions, in most instances one cubic centimeter. The chemical analyses that were made showed conclusively that the water obtained from the strainer system is filtered river water and not such as might be expected to have had a period of storage in the gravel deposits of the stream bottom. In fact, the filtered water followed very closely the character of the river water even though the variation in the latter was very rapid due to the subsidence of a flood during the period of the test.

From the investigation made, the conclusion must be drawn that the new additional source of supply is incapable of furnishing a water of satisfactory quality from a sanitary standpoint. It is not even likely that the system employed can be enlarged or improved to meet the demands of the village without excessive cost, for it must be remembered that but a very low rate of filtration is permissible, necessitating about four times the present area together with about 100,000 gallons storage to offset fluctuations in the rate of pumping.

September 3rd, 1909, the board of trustees of public affairs of Willoughby were notified that the results of the Board's investigation showed their present water supply, which had never been submitted to the State Board of Health for approval as required by law, to be entirely unsatisfactory from a sanitary standpoint and could not be regarded as safe; that recent outbreak of typhoid fever in the village seemed attributable to the use of this polluted supply, and the Board had therefore disapproved of the supply and advised that steps be taken at once looking towards a new supply, or the proper purification of the present supply.

REPORT ON PROPOSED NEW WATER SUPPLY FOR ZANESVILLE.

On June 22, 1908, the board of public service of Zanesville submitted a communication requesting the State Board of Health to approve, as a new source of water supply, certain wells located on the easterly bank of the Muskingum River north of the city. This communication was referred to a committee consisting of Dr. J. C. Crossland, Dr. Frank Warner, and the chief engineer. The committee made the following report:

Present Conditions. The original water works were built in 1840 and have gradually developed into the existing works. Water is taken directly from the Muskingum River at a point which is now scarcely above the thickly settled portion of the city. A pumping station is located at this point and the water is pumped to two distributing reservoirs and also to a standpipe which supplies the higher portions of the city.

The Muskingum River above Zanesville has a watershed of some 6,000 square miles and contains 27 municipalities, 19 of which have systems of sewers. Fifteen public institutions also discharge sewage into the stream. Taking the entire watershed, the population per square mile is about 80, which is not excessive when viewed from the standpoint of general pollution of the Zanesville water supply. The nearest source of pollution to Zanesville is the city of Coshocton, 30 miles above, having an estimated population of 6,500. Probably the greatest danger from sewage pollution of the water supply comes from the sewers of Zanesville itself and from factories on the westerly side of the river not far above the intake. During times of low flow, there is little current above the dam so that a wind blowing from a southerly direction would have a tendency to drive the pollution from the city sewers over the water works intake.

The quality of the Muskingum River at various points was investigated by the State Board of Health in 1899. Numerous chemical and bacterial analyses made at that time showed that on account of the high turbidity of the Muskingum River water, it was at no time suitable for domestic use without purification. The excessive amount of mud in the present supply is shown by the deposits which accumulate in the distributing reservoirs which have to be cleaned at least twice a year. This feature, together with the constant danger of sewage pollution, makes it an unsatisfactory supply in its raw state. It could, however, be readily filtered and rendered very satisfactory.

Previous Actions of the State Board of Health. In 1900 the State Board of Health approved a proposed new water supply to be derived from wells opposite the present pumping station on land bordering the Muskingum River. Analyses of samples from a test well in this locality, after a 26 days pumping test, showed a hygienically safe though somewhat hard ground water. No steps were taken further toward developing the supply.

Four years later, in 1904, it was proposed to obtain a new supply from driven wells located in a gravelly plain varying in width from 0 to 1500 feet and bordering the easterly bank of the river above Zanesville. The southerly portion of this plain is about half a mile above the present pumping station and two miles from the center of the city. The material which composes the plain consists of two or three feet of clay below which is sand and fine gravel to a depth of 50 feet or more. The ground water is at the same elevation or a little higher than the water in the river. Test wells were driven in this location and subjected to a rather incomplete pumping test. Analyses of samples of water from the test wells driven showed satisfactory results from a sanitary standpoint, although the water was unsatisfactory from the standpoint of hardness and iron. These wells were approved by the State Board of Health as a source of water supply, and recommendations made that the pumping station be so designed that it could be made a part of a future filtration plant and so located that an intake into the Muskingum River at a point above all pollution from the city could be constructed economically should it be necessary in the future to resort to the river for a supply. No further steps, however, were taken toward developing the supply.

Proposed Supply Now Under Consideration. In the spring of 1908, the matter of an improved water supply was again agitated, and the board of public service caused to be made further tests of the above mentioned wells approved by the State Board of Health in 1904. On account of the development in the art of softening water since 1904 and the fact that the disadvantages of hard water have been more prominently brought out than previously, and also in view of increased powers given the State Board of Health by the legislature since 1904, the Board considered that the project should be taken up anew and viewed from a broader standpoint.

The recent pumping tests were made by means of compressed air and the Harris air lift, and were conducted by the manufacturers of the latter device. Water was pumped into a box containing at one end a weir over which the water was discharged into a sluiceway and thence to the river. During the test, samples were collected and chemical and bacterial determinations made. These together with the analyses made in 1904 are herewith appended. From the standpoint of available quantity, the recent tests show that each of the test wells will yield about 500,000 gallons per day, the water level being lowered about 20 feet during pumping.

Considering all the analytical data available, it may be said that the ground water contained in the plain which it is proposed to use as a source of water supply is of somewhat varying quality. The water from certain portions at least contains objectionably large quantities of iron. All the results indicate that the hardness of the well water is much greater than the average hardness of the river.

More detailed information regarding the present water supply as well as the recent pumping tests, is on file with the State Board of Health in the form of printed and typewritten reports. The board of public service has caused to be made, by an engineer, an extensive report covering the proposed scheme including estimates of cost. The conclusions of this report, however, are not entirely agreed with by your committee.

Looking at the matter from a broad standpoint, it should be realized that in general it has not been found feasible to supply cities of the size of Zanesville with ground water. Pumping tests such as have been made are at best unsatisfactory and inconclusive with schemes as extensive as that now proposed. On the other hand, Zanesville is located upon a large river which is capable of supplying abundant quantities of water indefinitely. This is a natural resource which is enjoyed by but few cities in the state, and it should not be abandoned without grave consideration.

The people of Zanesville have always been used to a reasonably soft though muddy water. For this reason rainwater cisterns are not common and houses do not generally contain double plumbing systems for the purposes of providing hard and soft water. It is, therefore, to be expected that the citizens will strongly object to being forced to depend upon a water which is so much harder than they are now using. For steam and manufacturing purposes the disadvantages and financial loss would be great.

The State Board of Health has made a general ruling that plans for proposed water supply and other projects should first be confirmed and adopted by the local officials before being presented for approval to the State Board of Health. In the case of Zanesville, we are informed that the plan for the proposed well system has been adopted only by the board of public service and that council has taken no action in the matter. The committee is further informed that opinion among members of the board of public service and council as well as among the citizens, is divided. For this reason, it seems advisable that the proposed scheme be officially adopted by the local council before final action is taken by the State Board of Health.

At a meeting held January 20, 1909, the State Board of Health adopted the committee's report but no definite action relative to approval or disapproval was taken at this time. Based on the recommendations of the committee, the following advice was sent to the board of public service:

> The State Board of Health has most carefully considered your application of June 22, 1908, for approval, as a new source of water supply, of wells located on the easterly bank of the Muskingum River some two miles above the city. The reason why no formal communication in answer to your application has hitherto been sent, is due to the fact that the report of your consulting engineers was not received previous to the last regular meeting of the Board on October 20, 1908, at Dayton; hence, there was no time for the committee having the matter in charge to report upon same.
>
> A large number of bacterial and chemical analyses have been made of water from the proposed wells, and we have carefully studied the results of pumping

tests which have been conducted under your direction. The analytical results show that while the water is safe from a bacterial standpoint, it is objectionable on account of its hardness and on account of the varying amounts of iron therein contained. The quantity of iron would, in the opinion of the Board, probably increase with continued pumping.

The pumping tests which have been made indicate adequate quantities of water, although it is believed that with a project of this size such tests by no means furnish a guarantee that you will secure enough water to supply the city some years hence. Even after the supply is developed and machinery installed, there will always be the danger of its failing. The water, as shown by analysis, comes from the ground and not the river, and the watershed tributary to the wells does not appear to be of a size and character as to indefinitely yield a sufficient quantity of water. On the other hand, Zanesville has the natural advantage of being located on a large river which will furnish an ample water supply for the city for all time. From the standpoint of quantity, the abandonment of the Muskingum River for a source of supply which is uncertain, is, in the opinion of the Board, unwise.

Referring to the hardness and iron in the water, the latter can probably be removed without much difficulty or expense. The cost of removing the hardness, however, would be great. On the other hand, there must be recognized the disadvantages and expense to householders and manufacturers incidental to using water as hard as that which would be furnished by the wells.

In Zanesville, where the people are accustomed to the use of fairly soft water, there would be undoubtedly many complaints on account of the clogging of steam heating systems, and hot water heaters, the coating of cooking utensils, the extra amount of fuel necessary for cooking, and also on account of the excessive amount of soap necessary for washing and other domestic purposes. The adoption of the well water system of supply would probably necessitate the building of cisterns pretty generally over the entire city. This would call for pumps, and in many of the homes, where there is now water piped into them, it would involve a double system of plumbing in order to bring the cistern water to the bath, to the washstand, and to the kitchen. Without this double system of plumbing, the use of the proposed wells would mean the use of a hard water for washing, bathing, and all domestic purposes. The expense to the city as a whole on account of hard water would exceed such increase in water rates and taxes as might be necessary to pay for a filter plant to treat the Muskingum River water.

The above objections to the well system, as will be noted, are not based on what are generally considered strictly sanitary grounds. The Board is of the opinion, however, that as the question of the new supply for Zanesville is one which will affect the citizens for many years in the future, the matter should be looked at in a broad way; and that the Muskingum River, a natural resource of which many cities would be proud, should not be abandoned without due cause. The Board believes that the development of the wells as proposed is not in accordance with the best interests of the city and will not afford the best procurable supply. The Muskingum River water, properly treated by filtration, would afford, at reasonable cost, a supply which would be satisfactory from all standpoints.

A ruling of the State Board of Health has been that all proposed plans should first be confirmed and adopted by the local officials before being presented to the State Board of Health for final action. The council of Zanesville has not to our knowledge adopted nor confirmed the proposed scheme, and there is difference of opinion among the local officials and citizens in regard to the wisdom of doing so. When, therefore, the plans are adopted by council, the State Board of Health will immediately take action relative to definitely approving or disapproving them.

At the request of the local authorities at Zanesville that some definite action be taken, the Board at a meeting held October 14, 1909, reconsidered the matter of a public water supply to be derived from wells located on the Hague farm and voted to disapprove the project.

During the summer of 1909, while the well proposition was still in an unsettled state, Mr. F. L. Smith interested the local authorities in what he termed the Smith system of natural sand filtration. This system consisted briefly in placing a large number of Cook well strainers arranged in gridiron form from four to six feet underneath the sand and gravel deposits in the bed of the Muskingum River a short distance above the present pumping station. The area covered by the strainers was to comprise about two acres. It was expected that this system would yield a sufficient quantity of water by direct pumping for a number of years to come. Provision was made in the plans for back flushing the strainers should they show a tendency to clog.

As conditions at Zanesville seemed to be unusually favorable for the installation of this system, it was deemed advisable to carry out rather extensive tests to ascertain the quality of water that might be derived from the sand and gravel deposits occupying the bed of the stream. These tests consisted in first exploring the bed of the river for a distance of about one mile above the pumping station by means of well points. At what appeared to be the most favorable location, a strainer unit was installed and pumped at a rate comparable with that which it was proposed to use in practice. As these preliminary tests seemed to confirm the feasibility of the proposition and as early action on the part of the State Board of Health was desired before any more money was spent by the promoter of the system for experimental purposes, the project was submitted to the Board for its consideration.

On September 9, 1909, the Board approved a new water supply for Zanesville known as the Smith system of natural filtration, subject to the following conditions:

1st. That further well point tests be made over area proposed for location of strainer system;

2nd. That complete detailed plans embodying description of proposed methods of construction be submitted to and receive the approval of the State Board of Health before construction is begun;

3rd. That it is understood that the State Board of Health does not affirm that results will be satisfactory though preliminary investigations were rather favorable; and further, that if in the opinion of the State Board of Health the water fails to prove of satisfactory quality, the city agree to improve the supply by proper means or seek a new supply to meet the approval of said Board; and,

4th. That this approval be considered void unless construction shall have been begun not later than July 1st, 1910.

In compliance with the condition of approval requiring further well point tests, the exact area proposed for the location of the strainers was further explored. These tests were disappointing in that they showed a great variation in the quality of the water within a very small radius. This variation in the quality was entirely due to the mineral content. At some places within the area where well points were driven it was found that the water was highly impregnated with iron, and at other places it was found that the water was excessively hard. The second tests demonstrated such unfavorable conditions that the promoter of the system voluntarily gave up the attempt to induce Zanesville to introduce this method of securing a water supply.

At a meeting held October 14, 1909, the State Board of Health considered the proposition in the light of the second set of tests and voted to rescind its action of September 9, 1909, approving conditionally a new water supply for Zanesville obtained by what is known as the Smith system of natural filtration.

APPENDIX.

In the following pages are shown the results of the analyses of several samples collected from the test wells driven in the plain on the east bank of the Muskingum River above the water works pumping station. The wells are all 8 inches in diameter and have the following depths:

No. 1, 49 feet 5 inches.
No. 2, 56 feet 9 inches.
No. 3, approximately 50 feet 8 inches.
No. 4, 50 feet 8 inches.

Well No. 1 is farthest up the river and is 4840 feet from the pumping station and 180 feet from the river; No. 2 is 4200 feet from the pumping stating and 110 feet from the river; No. 3, the one farthest down stream, is located at the beginning of the plain, but 28 feet from the river and about 2800 feet from the pumping station. These wells were all driven in 1904.

In 1908 there was driven a fourth well, No. 4, also 8-inch, and is 400 feet below well No. 2 and 230 feet from the river.

Zanesville — Proposed Water Supply From Driven Wells Above Pumping Station on East Bank of Muskingum River.

(results in parts per million.)

Source of sample	Well No. 1.	Well No. 2.	Well No. 2.	Well No. 3.
Date of collection	May 2, '04.	May 12, '04.	July 2, '04.	May 12, '04.
Number of sample	3609	3648	3798	3649
Turbidity	0	15	20	225
Color	9	10	10	17
N. as Free ammonia	.004	.002	.022	.530
Alb. Ammonia	.012	.012	.030	.056
Nitrites	.002	trace	.040	.450
Nitrates	0	0	0	trace
Oxygen required	.15	.50	1.07	1.70
Chlorine	2.5	4.6	8.9	10.4
Alkalinity	181	222	207	273
Incrustants	40	94	95	122
Total hardness	221	316	302	395
Total solids	246	378	392	472
Iron	trace	.7	0	5.0
Bacteria per c. c	800?	....	100	....
Colon present	not in 50 c.c.	....	not in 50 c.c.	....

Zanesville — Proposed Water Supply From Driven Wells Above Pumping Station on East Bank of Muskingum River.

(results in parts per million.)

Source of sample	Muskingum River opposite well.	Well No. 2*.
Date of collection	May 18, 1908.	May 18, 1908.
Number of sample	7572	7569 & 7570
Turbidity	approx. 100	approx. 5
N. as Free ammonia	.014	....
Alb. Ammonia	.086	....
Nitrites	.016	.020
Nitrates	0	0
Oxygen required	2.10	0.20
Chlorine	31.7	8.7
Alkalinity	112	208
Incrustants	0	....
Total hardness	112	....
Total solids	296	452
Loss on ignition	90	75
Iron	1.1	0.9
Bacteria per c. c	1075	7569=8 7570=10
Colon present	not in 1 c.c. yes in 100 c.c.	not in 100 c.c. (2 samples)

*Part of this sample was lost during transportation.

Sample No. 7571 — from discharge of sluice into river — contained 0.7 part per million of iron.

On May 22, 1908, another sample was collected from Well No. 2. This was shipped to the laboratory and when received contained a decided sediment of iron. By analysis it was found to contain 0.9 part per million of iron.

ZANESVILLE — PROPOSED WATER SUPPLY FROM DRIVEN WELLS ABOVE PUMPING STATION ON EAST BANK OF MUSKINGUM RIVER.

(RESULTS IN PARTS PER MILLION.)

Source of sample		Well No. 2.	Well No. 1.
Date of collection		June 2, 1908.	June 2, 1908.
Number of sample		7586	7588
Color		10	0
Turbidity		5±	0
Sediment		trace	0
Odor		earthy	0
Oxygen required		1.40	1.40
N. as	Alb. ammonia	.028	.030
	Free ammonia	.020	.004
	Nitrites	.002	.002
	Nitrates	0	0
Chlorine		10.8	9.1
Alkalinity		194	182
Incrustants		92.5	75
Total hardness		286	257
Total solids		432	340
Loss on ignition		48	38
Sulphates (SO_4)		115	91
Iron		0.6	0.1
Bacteria per c.c		11	45
Colon present		not in 50 c.c.	not in 50 c.c.

Water from Well No. 2 at point of discharge into the river contained 0.5 part per million of iron.

Water from Well No. 1 at point of discharge into the river contained 0.1 part per million of iron.

ZANESVILLE — PROPOSED WATER SUPPLY FROM DRIVEN WELLS ABOVE PUMPING STATION ON EAST BANK OF MUSKINGUM RIVER.

(RESULTS IN PARTS PER MILLION.)

Source of sample		Well No. 1.	Well No. 5.
Date of collection		June 5, 1908.	July 1, 1908.
Number of sample		7595	7619
Color		[illegible]	5
Turbidity		none	trace
Sediment		none	none
Odor		none	none
Oxygen required		1.60	.60
N. as	Ammonia alb	.022	.012
	Ammonia free	.014	.002
	Nitrites	.006	.010
	Nitrates	none	none
Chlorine		7.8	18.2
Alkalinity		182	158
Incrustants		....	140
Total solids		369	572
Loss on ignition		55	72
Iron		0.0	.6
Bacteria per c.c		....	....
Colon present		....	....

ANALYSIS OF SAMPLES FROM MUSKINGUM RIVER ABOVE ZANESVILLE.

(RESULTS IN PARTS PER MILLION.)

Date of Collection.	Sample Number.	Color.	Turbidity.	Alkalinity.	Incrusting Constituents.
1899.					
April 29	3	.20	.40	93.0	80.4
May 23	33	.25	.90	78.9	44.5
June 21	61	.25	4.30	51.7	30.4
July 27	119	.25	1.00	95.8	21.6
August 31	147	.25	.48	166.6	23.2
September 28	177	.30	.90	137.0	43.2
October 18	205	.25	.26	145.8	14.8
November 23	235	.25	.25	145.2	29.4
Average	......	.25	1.06	114.2	35.9

SEWERAGE AND SEWAGE PURIFICATION.

REPORT ON PROPOSED SEWAGE PURIFICATION FOR ALLIANCE.

On July 8, 1909, plans for proposed new sewage purification works for the city of Alliance were submitted by Messrs. Bradbury and Shute, consulting engineers, of Columbus, Ohio. These plans were referred to the engineering department for investigation. On July 20, 1909, the acting chief engineer visited Alliance and made an examination on the ground in company with the city engineer, Mr. George R. Gyger. The following report was submitted:

REPORT.

The city of Alliance is in the northeastern part of Stark County very near the Mahoning County line and on the south bank of the Mahoning River at a point above which the stream has a watershed of about 73 square miles. The population is locally estimated at 15,000, but a reasonable estimate based on United States Census reports would place the figure at about 11,000. The area within the corporation limits is about 2,100 acres, nearly all of which is tributary to the existing sewerage system. Alliance is primarily a manufacturing community comprising foundries, boiler works, machine shops, etc. None of the industries, however, produce appreciable quantities of wastes which may cause nuisance by their discharge into streams or interfere with the purification of sewage by their discharge into sewers.

The city as a whole presents a clean and well kept appearance, but street paving is in a rather poor state of repair, especially on the main business streets. The city is supplied with most modern improvements, including a public water supply which is drawn directly from the Mahoning River above local pollution. This supply is of inferior sanitary quality and the city authorities are at present contemplating the introduction of a new supply.

Past Actions of the State Board of Health. The matter of sewerage in Alliance was first brought to the attention of the State Board of Health in 1894 through a petition signed by a number of citizens complaining of the discharge of sewage and other wastes into an open ditch flowing through a thickly inhabitated portion of the city. During the investigation of this nuisance it was learned that the city was constructing a system of sewers on the separate plan. Owing to the fact that all the preliminary arrangements for the construction of this sewer had been made prior to the passage of the act requiring the approval of the State Board of Health for the construction of new sewerage systems, the matter was not submitted to the State Board of Health for approval.

Shortly after the installation of these sewers it became evident that some form of sewage purification would be necessary. Accordingly, on March 4, 1895, plans were submitted to the State Board of Health for a plant designed to purify the sewage by intermittent sand filtration, but before these plans were acted upon it was found necessary to change the system, owing to the impracticability of obtaining sufficient land. The revised plans provided for a chemical precipitation plant, a system of sewage purification in considerable favor at that time. These plans were approved by the State Board of Health, notice of which action was given in the following letter.

"COLUMBUS, OHIO, August 15, 1895.

MR. L. E. CHAPIN, *Consulting Engineer, Canton, O.*

DEAR SIR: The State Board of Health has examined the plans proposed for purification of sewage at Alliance, as submitted by you, and I hereby notify you that the plans have been approved by the Board.

Respectfully,
(Signed) C. O. PROBST, *Secretary.*"

The plant which was constructed in accordance with this approval is in operation at the present time, though the application of chemicals has been practically abandoned and the tanks are used as sedimentation basins. For a number of years this plant furnished an effluent which was fairly clear and which was discharged into the stream without creating an appreciable nuisance. In late years, however, the plant has been taxed considerably beyond its capacity.

In order to remove the pollution away from the immediate water front of the city, there was built in 1907, without the approval of the State Board of Health, an outfall sewer for the purpose of conveying the effluent from the purification plant to about one-half mile farther down stream.

On October 21, 1908, the board of trustees of Lexington Township, Stark County, petitioned the State Board of Health under the Bense Act to investigate the pollution by the city of Alliance of the Mahoning River and to order said city to adequately purify its wastes. An investigation of the conditions complained of was made by a committee of the Board, composed of a member and the chief engineer. The result of the investigation was an order on the part of the State Board of Health requiring the city of Alliance to purify its sewage in a manner satisfactory to the Board before December 1, 1909. It is in accordance with this action of the Board that the present plans for sewage purification are now submitted.

Existing Conditions. Before proceeding with a consideration of the proposed plans it will be well to review briefly existing conditions with respect to the pollution of the Mahoning River at Alliance. The dry weather flow of the Mahoning River at the point of discharge of the sewage effluent is 2,000,000 gallons per day, or 3.1 cubic feet per second.

As this quantity of water provides but 0.44 cubic foot per second per thousand population tributary to the sewers it is evident that the volume is not enough to dilute the sewage sufficiently to prevent a nuisance.

Owing to the small dilution afforded by the flow of the stream a strictly non-putrescible effluent, free from suspended matter which is likely to be unsightly or cause deposits on the bed of the stream, must be obtained in order to render the stream inoffensive. Further purification than this is not necessary for the reason that no additional pollution of serious consequence reaches the river between Alliance and Warren, a distance of 46 miles, in which great distance the water of the stream, even though grossly polluted, has an opportunity for almost complete self purification and, furthermore, the stream above the sewer outlet must continue to receive more or less unpreventable contamination from surface washings. At the present time, during low water the stream is rendered foul for a distance of three miles below the outlet sewer and the contamination can be readily detected by analytical methods for a distance of eight miles below. The contamination by sewage is not especially objectionable on account of odors since there are only a few houses sufficiently near the stream to be reached by the odors, but the stream is rendered altogether unusable for cattle watering and other purposes.

Proposed Changes in Sewerage System. As a preliminary to the discussion of the proposed sewage purification works, it will be well to consider briefly certain proposed changes in the sewerage system itself. There are at present 26 miles of sanitary sewers, all of which discharge through a main outfall sewer to the present sewage purification works. Storm water drains are constructed where needed and discharged into the nearest water course. The sanitary sewers are more or less imperfectly constructed and admit an abnormally large amount of ground water. The flow in the sewers is further added to by a large number of connections which have been permitted for carrrying off subsurface drainage and water from downspouts. Owing to the elevation of the site for the proposed new purification works it is not possible to obtain a gravity flow thereto from the entire city. It is, therefore, proposed to construct a high level intercepting sewer for the purpose of diverting sewage from the high level districts and causing it to flow to the sewage purification plant by gravity. This interceptor will on a rough estimate receive about four-fifths of the sewage flow of the city. The remaining portion of the city, or the low level district, will also have an intercepting sewer consisting in part of the before mentioned outfall sewer for conveying the effluent of the existing sewage purification works to a point farther down stream. This interceptor will convey the low level sewage to a pumping station, whence it will be raised and discharged into the high level interceptor, and thence flow by gravity to the purification works.

Quantity and Composition of Sewage. Before the discussion can be pursued further, it will be necessary to take up the quantity and composition of the sewage. The general sewerage system is designed to serve the needs of a total population of 50,000; at present there are but 7,000 persons connected. The normal flow of sewage is about 1,600,000, or about 229 gallons per capita. This large flow is in part due to an excessive per capita water consumption, namely, 230 gallons per day, but it is also due, as already noted, to considerable ground water leakage. The storm water flow reaches the high figure of 5,000,000 gallons in 24 hours which may be attributable both to increased leakage at such times and to the admission of water from downspouts and subsurface drains as already pointed out. The sewage, therefore, is very weak. Manufacturing wastes, as already noted, do not influence the character of the sewage. The consulting engineers present an estimate of future flow in the following table.

TABLE SHOWING PROBABLE QUANTITY OF SEWAGE FOR 40-YEAR PERIOD.

Year.	Normal.			Storm.	
	Gals. per Day.	Average Quantity.	Maximum Quantity.	Gals. per Day.	Cu. ft. per Sec.
1909	1,600,000	2.48	2.71	4,830,000	7.5
1920	2,000,000	3.10	3.40	6,050,000	9.35
1925	2,425,000	3.76	4.13	6,660,000	10.3
1930	2,850,000	4.41	4.86	7,250,000	11.2
1950	5,400,000	8.38	9.28	9,800,000	15.2

The figures contained in the above table are based upon the assumption that new sewers to be constructed within the period covered by the figures will have but half the ground water leakage and receive but half of the storm water flow per capita now reaching the present sewers. These flows are excessively great and in order to reduce the expense of operating and to prolong the life of the purification works a reasonable effort should be made to accomplish their reduction. This may be brought about in three ways: 1st. By reducing the water consumption by means of meters placed on house connections or otherwise. (The per capita water consumption should not exceed 100 gallons per day.) 2nd. By careful investigation of the water tightness of existing sewers with a view to replacing such sewers as prove to be excessively leaky. 3rd.

By the abolishment in so far as possible of connections with sanitary sewers for downspouts and subsurface drains.

The consulting engineers propose to design a plant which on the basis of the figures in the above table will serve the needs of the village for a period of fifteen years at least. This means that the plant must be capable of caring for the sewage of a population of about 12,000 representing a flow of 2,500,000 gallons in 24 hours during dry weather and 6,700,000 gallons during storms. The purpose for which the works is designed is described by the consulting engineers as follows:

> "This plant must be of a high bacterial efficiency, and produce a non-putrescible effluent during low or average water periods, and must be capable of handling the large storm flow for short periods without nuisance or injury."

Proposed Purification Works. Having considered the general features of the sewerage system and the quantities and characters of sewage which must be dealt with, the design and location of the purification works may next be taken up. The site for the purification works is in the extreme northern part of the city on a plat of land 13 acres in area on which the city now holds an option. This location is extremely well chosen being fully half a mile from the built up portion of the city and at least 600 or 700 feet from the nearest habitation. Within a thousand feet there are but several houses and it is not at all likely that their occupants will be subjected to odors from the plant. The land also lies at sufficiently high elevation so that the works need never be placed out of service by high water in the stream.

The process of sewage treatment may be briefly described as follows:

The sewage from the high level interceptor will be received into a screen chamber where it will be subjected to a rough screening, thence it will be conducted through a suitable distributing channel to the sedimentation basins. From the sedimentation basins the sewage will be conducted to a chamber from which it will be diverted in equal portions to several groups of contact filters. The contact filters will cover a total area of three acres and will be 5 feet in depth. This area will be divided into twelve beds arranged in three groups of four beds each. It is proposed under ordinary conditions that but two groups be in service at one time and these will be fed by the diverting arrangement above mentioned. The sewage will be received in chambers located at the center of each group, whence it will be automatically diverted to the several beds of each group in rotation. From the contact beds the sewage will be conducted to fine grain filters; three acres of these filters are contemplated as a first installation, but the plans show two additional acres to be constructed at a future period. The three acres for present installation will be divided into three beds and will be operated as continuous filters rather than intermittent filters. Each filter will receive the discharge from one of the group of contact beds. The fine grain filters will be used for disposing of sludge from the settling tanks.

The various devices above enumerated may be now taken up more in detail, especially with relation to the rates of filtration.

Screen Chamber. The screen chamber will be 8 feet by 8 feet in plan and will have a normal depth of flow of 3.18 feet. The screen will be composed of rectangular iron bars supported vertically in a frame and the frame will rest in grooves formed in the concrete sides of the chamber. These grooves will be inclined toward the incoming sewage and will form an angle to the vertical of about 60 degrees. The screen will have clear openings of 1¾ inches. This spacing is rather large and may be expected to intercept only the large particles, but it is believed by the consulting engineers that the treatment in the sedimentation basins will effect a sufficient decomposition of the solid particles to render finer screens unnecessary. However should experience prove the desirability of finer screens they may be introduced at any time.

Sedimentation Tanks. There are three sedimentation tanks each 132 feet long and 42 feet wide inside dimensions and having an average depth of about 9 feet to the flow line. This represents a total capacity of 1,165,000 gallons, or 11.2 hours' flow during dry weather and 4.2 hours' flow in time of storm. These tanks are arranged to operate with either two or three in parallel or all three in series. The tanks will not be covered since owing to the remote location of the works from habitation this is not deemed necessary. The diverting arrangement at the outlet chamber of the sedimentation tanks is so arranged that approximately equal quantities of sewage may be diverted to each of the three groups of contact beds. In ordinary practice, however, it is proposed to use but two of the groups but the arrangement is such that during periods of storm the third group will be automatically thrown into service after the flow attains a predetermined rate.

Contact Beds. The three acres of contact beds represent a rate of treatment during dry weather of 835,000 gallons per acre per day, or 167,000 gallons per acre-foot per day. During storms the rate of treatment will be 2,230,000 gallons per acre per day, or 446,000 gallons per acre-foot per day. These rates are very high when considered in the light of the quantity of sewage flowing, but when based on the estimated population which will be tributary there is obtained a rate of 4,000 persons per acre or 800 persons per acre-foot. This is quite conservative. The filtering material to be used is similar to that used at Mansfield and which has given notably good results. It will consist of screened locomotive cinders of such size that all will pass a screen having a ¾-inch mesh and will be retained by a screen having a ¼-inch mesh. The bottoms of the beds will be liberally under-drained so as to effect a rapid drainage at the end of the contact period. No provision is made for distributing troughs on the surface as it is believed that economy will be effected in maintaining the filters in repair by discharging the sewage all at one point thereby limiting the clogging of the material to a small area. The wisdom of this arrangement would seem to be borne out by experience both at Mansfield and Marion. As already observed, the contact beds will be automatically operated by suitable apparatus located in chambers placed at the centers of each group of beds. The type of apparatus has not as yet been definitely decided upon but will probably be either that manufactured by Merritt and Company, or that manufactured by The Pacific Flush Tank Company. Either type should give quite satisfactory results. The cycles of operation of the contact beds have been worked out by the consulting engineers as follows:

1st. Two units operating, present normal flow equals 1,600,000 gallons per day.

Bed Fills.	*Stands Full.*	*Empties.*	*Stands Empty.*
4 h. 3 m.	4 h. 3 m.	2 h. 30 m.	5 h. 36 m.

2nd. Same 10 years hence, 2.000,000 gallons per day.

3 h. 14 m.	3 h. 14 m.	2 h. 30 m.	3 h. 58 m.

3rd. With present storm flow, three units operating (4,830,000 gallons per day).

2 h. 6 m.	2 h. 6 m.	2 h. 30 m.	1 h. 42 m.

4th. Same 15 years hence (6,650,000 gallons per day).

1 h. 27 m.	1 h. 27 m.	2 h. 30 m.	0 h. 25 m.

5th. Three units in operation, one bed of each unit resting, 15 years hence, normal flow 2,425,000 gallons per day.

4 h. 3 m.	4 h. 3 m.	2 h. 30 m.	1 h. 24 m.

Fine Grain Filters. The piping from the contact beds to the fine grain filters is so arranged that each contact group may be discharged onto either of two filters, and when the five fine grain filters are completed the arrangement of piping will be such that each group of contact filters may discharge onto any of three filters. With the three filters in use it will thus be necessary for the fine grain filters to operate continuously. In actual operation one filter will be confined to each group of contact beds and will be out of service with its corresponding group. The three acres for present installation provide for the same rate of filtration as in the contact beds, namely, 835,000 gallons per acre, during periods of dry weather, 2.230.000 gallons per acre during periods of storm, and a population tributary of 4,000 per acre. With the five acres ultimately to be installed the rate of filtration will be 500.000 gallons per acre per day during dry weather and 1,340.000 gallons per acre per day during period of storm. The population tributary will be 2,400 per acre. The filtering material proposed is fine screenings from locomotive cinders and it is anticipated that the material screened from the contact beds may be utilized. The average depth of filtering material will be 3 feet. The lower 6 inches will be composed of coarse material to facilitate underdrainage. Vitrified sewer pipe will be used for underdrains and spacing will be sufficiently close to insure a free flow. The sewage entering the fine grain filter will be distributed by troughs discharging at three points. A more complete distribution is not believed to be necessary as it is thought during actual operation that the filters will always be covered with sewage. So far as can be learned there is no precedent for the use of a filtering material of this character in fine grain filters operated at a high rate. It would hardly seem warrantable, therefore, to permit the construction of a plant of this size without some preliminary experiments as to the feasibility of the use of such material.

Elevations. Having reviewed in some detail the design of the purification works a few elevations may be given to show the relation of the plant to the various stages of the water in the river. The elevation of the sewage in the sedimentation tanks will range from 41.0 to 43.0. The elevation of the bottoms of the contact beds will be at about elevation 34 giving a 3 foot fall to the surface of the fine grain filters which is at elevation 31. The invert of the main drains of the fine grain filters will be at 26.74. The elevation of low water in the Mahoning River varies from 16 to 18, average high water is at 25, and maximum high water may reach elevation 28. It will thus be seen that only during very high water will the operation of the fine grain filters be interfered with, and only then to the extent of backing up in the underdrains to a height of about 1 foot. At times when the river is at such a stage there can be no objection whatever to discharging the effluent from the contact beds or even the raw sewage into the river.

At a meeting of the State Board of Health held August 5th, 1909, these plans and specifications for sewage purification for the city of Alliance, submitted July 8th, 1909, by Messrs. Bradbury and Shute, consulting engineers, were considered, and the plans were approved provided:

1st. That fine screenings from locomotive cinders be not used as a filtering material in the fine grain filters, unless its suitability for such purpose is demonstrated to the satisfaction of the State Board of Health on an experimental scale;

2nd. That before January 1st, 1911, the city cause a thorough investigation to be made of the feasibility of reducing the abnormally high sewage flow with a view of extending the life of the purification works as at present designed, and that such investigation treat upon three points as follows:

(a) The reduction of the abnormally high per capita water consumption by the installation of meters on service connections, or otherwise.

(b) Measurements of sewage flow for detecting leakage of ground water with a view to renewing portions of sewers in especially bad repair.

(c) The reduction of storm water flow by the disconnection of down spouts and all subsurface drains.

3rd. That when the work outlined in the preceding condition is completed a full detailed report thereon be submitted to the State Board of Health.

4th. That a shelter house be provided at the site of the purification works which will offer suitable shelter in all weather for a caretaker, serve as a store house for tools and implements that may be required for the upkeep of the plant and furnish a convenient place for conducting simple laboratory work which might be required in the daily control of the plant and for making special tests.

In addition to these conditions of approval the Board suggested that water from the public water supply be made available at the site of the purification works for sprinkling, for flushing, and for use in connection with tests on the efficiency of operation.

REPORT ON PROPOSED SEWERAGE AND SEWAGE PURIFICATION FOR ARCHBOLD.

At the request of Mr. George Champe of Toledo, consulting engineer for Archbold, one of the assistant engineers while in the northwestern part of the state visited that village August 26, 1908, for the purpose of making a preliminary examination of the local conditions with reference to proposed sewerage and sewage purification. Much assistance was rendered during this visit by Mr. August Ruihley, village clerk. Informal advice based on this examination was embodied in a letter to the consulting engineer under date of October 8, 1908. On November 9, 1908, a letter was received from the consulting engineer outlining in general terms a proposed system of sewers. This was followed by informal correspondence in the course of which certain changes in the design of the sewerage system and the immediate installation of purification works were recommended. The following report was based on revised plans received April 22, 1909:

Archbold is in the southwestern part of Fulton County on the main line of the Lake Shore & Michigan Southern Railway. The nearest stream is Brush Creek about one-half mile to the southward. The watershed of this stream above Archbold has an area of about 34 square miles. Below the village the stream flows through open county and receives practically no contamination. The water ultimately reaches Defiance which is 26 miles distant.

The population of Archbold is locally estimated to be from 1,000 to 1,100. Practically the whole of the built up portion of the village is on or adajcent to a single main street. The area within the corporation limits as well as the surrounding country is quite level and has a gentle slope to the northward.

Archbold is primarily a farming center but contains several wood-working establishments, the largest of which employs about 30 men. The village in general has a clean and thrifty appearance, but there are practically no public improvements other than about half a mile of brick paved streets. Owing to the flatness of the locality, storm water is but slowly removed and there has been considerable difficulty due to flooding of cellars and at times even of the streets in the central portion of the town, which difficulty the existing poorly constructed public and private drains are inadequate to relieve. The removal of cellar drainage and storm water from the streets constitutes the principal reason for installing a sewerage system, but owing to the increasing use of modern plumbing, it is desired that the proposed sewers care for sanitary sewage also.

PROPOSED SYSTEM OF SEWERS.

The proposed system of sewers is designed on the separate plan and for present installation includes a single sanitary and a single storm sewer in Defiance Street, both laid in the same trench and extending through the whole length of the town in a north and south direction. The total length is something over a mile. As required, laterals to these main sewers may be placed in the side streets. The storm water sewer will begin at the northern end of the corporation with a bore 15 inches in diameter and will be enlarged at intervals until at its outlet it will have a diameter of 48 inches. The height of the outlet will be at elevation 62, or 4½ feet above low water in Brush Creek. The sanitary sewer will be above the storm water sewer, will start with a bore of 10 inches, and will be enlarged at intervals until at its outlet it will have a diameter of 15 inches. The height of the outfall of the sanitary sewer will be at elevation 66.50, or about 9 feet above low water in Brush Creek. The grade of the sanitary sewer is somewhat small, being but 0.15 per cent throughout most of its length, but with good construction and suitable provisions for flushing, it is believed that this will be sufficient. It must be noted, however, that adequate flushing will be difficult to obtain until a public water supply has been installed. The laying of the sanitary sewer above the storm sewer has several distinct advantages; first, it is not likely that the storm sewer will be tapped for sanitary purposes as sometimes happens in communities having the combined system of sewers; and second, the storm sewer will act to a certain extent as an underdrain for the sanitary sewer, thereby preventing difficulties at the purification works due to excessive quantities of ground water.

Flow of Sewage. Owing to the fact that Archbold has as yet no public water supply and that further there is not much likelihood of a water supply being installed within the next five years, the quantity of sanitary sewage will be very small. A safe estimate of the number of people that will become tributary to the sanitary sewers previous to the installation of the public water supply is 200, and it is not probable that the per capita flow will exceed 50 gallons per day, which makes a total flow of 10,000 gallons per day. Accordingly, a purification works capable of handling 10,000 gallons of sewage was considered ample for all present needs.

PROPOSED SEWAGE PURIFICATION WORKS.

The purification works shown on plans submitted comprise (1) a screen chamber; (2) a sedimentation tank; (3) a dosing chamber; and (4) three intermittent sand filters.

After screening, the sewage will pass into the sedimentation tank. This tank will be 20 feet long, 10 feet wide, and 6 feet in depth to the flow line, thus giving it a capacity of 9,000 gallons or about 20 hours flow. This capacity is ample for the amount of sewage expected to reach the plant. The general design of the plant is in all respects satisfactory.

The dosing chamber follows the sedimentation tank and will be 8 feet by 10 feet in plan and 4 feet in depth to the flow line, thus giving it a capacity of 2,400 gallons This quantity of sewage spread out on one of the sand filters will give a depth of a little over one inch. There will be installed an automatic dosing apparatus consisting of three alternating siphons. The same will be arranged so that any siphon may be thrown out of service for cleaning or repairing the filter on to which it discharges.

Each filter will be 66 feet 9 inches long and 54 feet wide at the sand line. These dimensions represent an area per filter of 3,600 square feet, or a total area of 10,800 square feet which is equivalent to about ¼ acre. The filtering material will consist of a 3-foot layer of sand supported upon a layer of crushed stone surrounding the underdrains. The underdrains will be placed about 14 feet apart. The sewage will be distributed over the surface of the beds by a system of wooden troughs. The outlet of the main underdrain to the filters is but 0.9 foot above low water in Brush Creek and but 0.4 foot above the normal stage of the stream. During floods, the water in the creek may rise above the level of the surface of the sand, but owing to the small tributary drainage area, flood periods are not apt to be of more than several days duration. During such times there is no objection to discharging the crude sewage into the creek.

The plans for proposed sewerage and sewage purification as shown on the drawings submitted by Mr. George Champe of Toledo, consulting engineer, on April 22nd, 1909, were approved by the Board on May 7th, 1909, provided:

1st. That detailed plans of the dosing apparatus be submitted to and receive the approval of the State Board of Health before the same is installed.

2nd. That samples of sand and crushed stone to be used in the intermittent sand filters be submitted to and receive the approval of the State Board of Health before being placed.

3rd. That this approval be considered void after June 1, 1910, unless construction in accordance with plans submitted shall have been begun by that date.

REPORT ON PROPOSED STORM WATER SEWERS FOR ATHENS.

Plans were received on May 19, 1909, from the city solicitor and the city engineer of Athens, Athens County. These plans were referred to the engineering department, which submitted the following report:

Information as to the location of these proposed storm water sewers and local drainage conditions was obtained in April, 1908, when the storm sewer project was first contemplated by the Athens authorities. The sewers proposed are strictly storm water sewers and are planned to drain extensive areas in east and south Athens. The principal branch will start from the center of the city and will extend in an easterly direction to the Hocking River, into which the storm water will discharge at a point below the lower dam. These sewers will drain the low land in east Athens which has long been inundated after storms. The branch from south Athens will enter the main sewer at Elliott Street.

These storm sewers are planned to carry 200 sec. ft. of sewage and drain an area of 223 acres. The total length of the proposed sewers is about 8.58 miles. The sewers contemplated are estimated to cost about $25,850, and are to be constructed of brick and vitrified sewer pipe as follows:

MAIN STORM WATER DRAIN AND LATERALS.

3,850 ft., 16.8 sq. ft. cross section, brick.
1,700 ft., 11.0 sq. ft. cross section, brick.
8,750 ft., 12-inch, vitrified sewer pipe.
8,740 ft., 15-inch, vitrified sewer pipe.
7,025 ft., 18-inch, vitrified sewer pipe.
6,600 ft., 24-inch, vitrified sewer pipe.
Total, 36,665 feet or 6.9 miles.

SOUTH SIDE DRAIN AND LATERALS.

3,850 ft., 16.8 sq. ft. cross section, brick.
1,200 ft., 12-inch, vitrified sewer pipe.
2,270 ft., 15-inch, vitrified sewer pipe.
1,262 ft., 24-inch, vitrified sewer pipe.
Total, 8,882 feet or 1.68 miles.

May 24th, 1909, the State Board of Health approved the plans for proposed storm water sewers, submitted May 19th, 1909, by the city solicitor and city engineer, provided:

1st. That the city council first pass and file with the State Board of Health an ordinance forbidding the tapping of all sewers shown on plans submitted and any future sewers tributary thereto, for the purpose of admitting water closet wastes, sink drainage, or household wastes of any kind; and,

2nd. That this approval be void after June 1st, 1911, unless construction of the sewers is commenced before that date.

REPORT ON PROPOSED SEWAGE PURIFICATION FOR THE AUGLAIZE COUNTY INFIRMARY NEAR WAPAKONETA.

On January 15, 1909, there were submitted by Messrs. Bradbury and Shute of Columbus, consulting engineers for the Auglaize County Infirmary near Wapakoneta, plans and specifications for sewage purification for that institution. These plans were referred to the engineering department, and the following report was made:

The Auglaize County Infirmary is an institution comprising one building and having a population of about 75, located about one mile northwest of Wapakoneta. The drainage from the ground occupied by the institution as well as a small amount of sewage therefrom, is into Two Mile Creek, a tributary of the Auglaize River. A new building is being constructed along modern lines; hence, the reason for installing sewage purification works. No public water supply is affected by the discharge of sewage into the creek from the infirmary.

On the basis of 100 gallons per capita, the flow of sewage would be 7,500 gallons per day. The plant, however, is designed to treat 10,000 or more gallons.

It is proposed to construct an 8-inch sewer leading from the infirmary building to a point about 1,500 feet west, where the purification works are to be built. At the upper end of this sewer close to the building is a flush tank and screen chamber containing a screen having an open space of one inch. The screen is to be cleaned at regular intervals.

After being screened, the sewage passes through the 8-inch sewer to a distribution tank which constitutes the first portion of the purification works. The distribution tank is of concrete, 30 feet long and 8 feet wide. The sewage will accumulate in this tank until it has reached a depth of about 18 inches, when it will be discharged by 5-inch alternating Miller siphons on to the sand filters. Based on the nominal capacity of the plant, the tank will discharge $2\frac{3}{4}$ times a day, each dose comprising 2,725 gallons.

The filter beds are located a few hundred feet beyond the dosing tank and are six in number. Each bed is in the form of an equilateral triangle giving the whole area the form of a hexagon. At the center of this hexagon is a gate chamber which receives the sewage from the distribution tank through two different inlets, each connecting with one of the alternating siphons. This has the effect of dividing the total area into two sets of three filters each. Each set will receive the dose alternately and the dose may be discharged upon one, two, or three filters. If one filter is used, it will be flooded at each dose to a depth of $4\frac{3}{4}$ inches.

The underdrains consist of 4-inch tile pipe, the drainage of each filter being toward the center. Over the underdrains is to be placed screened gravel to a depth of 6 inches, and above this there will be $2\frac{1}{2}$ feet of sand. Samples of the sand are submitted with the plans and are excellent for the purpose.

The final effluent will enter an old tile drain leading to Two Mile Creek.

At a meeting of the Board held January 20th, 1909, these plans were approved.

REPORT ON PROPOSED SEWERAGE AND SEWAGE PURIFICATION FOR CARTHAGE.

The matter of proposed sewerage and sewage purification for Carthage was first brought to the attention of the State Board of Health through a communication written on behalf of the village under date of April 11, 1908, from Messrs. Clinton Cowen, county engineer, and Samuel W. Bell, legal counsel for the village. This communication requested a preliminary investigation which was accordingly made on April 15, 1908, by a committee of the Board composed of Dr. Stanton, then vice-president, and one of the assistant engineers. Based on this preliminary investigation, a report was submitted under date of April 20, 1908. On April 24, 1908, an informal letter of advice was sent out through the secretary's office to Mr. Cowen, embodying the conclusions of this report, which pointed out the unsuitability of the combined system of sewers which had been contemplated and recommended instead a separate system of sewers with purification works.

On April 14, 1909, a complete set of plans including purification works was submitted for the approval of the Board. These plans were reviewed by the engineering department but as certain features of the purification works proved to be of unsatisfactory design, the matter of submitting the plans to the Board for formal action was deferred and instead an informal letter of advice was sent out. Following this letter and at the request of Mr. Cowen, one of the assistant engineers visited Cincinnati and Carthage for a conference and for the purpose of inspecting the proposed site for the purification works.

On June 4, 1909, pencil sketches of revised plans for the purification works were referred to the engineering department for criticism which was embodied in an informal letter under date of June 17, 1909. On July 6, 1909, finished revised plans were submitted and these form the basis of the following report:

Carthage is a village of about 3500 population in Hamilton County just a few miles north of the northern corporation line of Cincinnati. The total area within the corporation limits is estimated at about 400 acres. The village lies in the bottom lands of Mill Creek Valley which in this vicinity has a width of from one-half to one mile. This valley is of glacial origin and has been filled to a depth of 150 feet or more with drift deposits consisting of strata of sand, gravel, and clay. The site upon which the main portion of the village is built is a nearly level terrace formed by these drift deposits, from 20 to 30 feet above the bed of the stream.

The village is populated principally by the middle class, some of whom are employed in Cincinnati but most of whom are engaged in various industries located in and near Carthage. These industries include carriage works, iron works, a tar paper factory, a large distillery, and other industries of minor importance. employing in all from 700 to 800 men.

Carthage has, with the exception of sewerage, all the more necessary municipal improvements, including water works, electric lights, and a considerable length of paved streets. The need of an adequate system of sewers has long been felt but the finances of the village have not warranted their construction. At the present time there is a prospect of the village being incorporated with the city of Cincinnati, which if consummated will result in the indebtedness of the village being assumed by the city at large. With this prospect in view, the village now feels warranted in incurring the indebtedness necessary to meet the construction of an adequate system of sewers.

PROPOSED SEWERS.

Following the informal advice of the State Board of Health, the system of sewerage proposed is strictly on the separate plan. As indicated by the plan submitted, the design is in accordance with the best accepted practice and the cost of the present installation of sewers exclusive of purification works is expected to total about $50,000. The above comprises the following lengths of pipe and accessories:

18-inch pipe,	1,800 feet.
15-inch pipe,	1,280 feet.
12-inch pipe,	1,635 feet.
10-inch pipe,	2,135 feet.
8-inch pipe,	38,956 feet.
Total,	45,806 feet or 8.68 miles.

In addition to the above, there will be 205 feet of 14-inch cast iron pipe and 210 feet of 8-inch cast iron pipe for inverted siphons. There will be 43 flush tanks, placed at the various dead ends, and 105 manholes. All pipe will be made of vitrified sewer tile and will be laid with cemented joints in an approved manner. The ventilation of the system will be through manholes and house connections. All of the sewage will be conducted to the southwest corner of the corporation where it will be carried under Mill Creek through inverted siphons to a suitable site for the location of purification works just outside the corporation.

Capacity of System and Flow of Sewage. It is believed that the arrangement of the sewer pipes and the size of the trunk sewers is such that the system will serve the needs of the village for fifty years to come with any reasonable growth that may be anticipated. For the next five years, however, it is not probable that more than 2,000 persons will become tributary to the sewers. Assuming a flow of 75 gallons per capita, there will result at the end of this time a daily flow of 150,000 gallons, and it is considered by the engineers that a purification plant capable of handling this quantity of sewage is all that is necessary for present installation.

PROPOSED PURIFICATION WORKS.

Site. As already noted, the site for the purification works is just outside of the southwest corner of the corporation and on the opposite side of Mill Creek. About eight acres of land have already been optioned by the village, and no difficulty is anticipated in acquiring more land when needed. Within a few hundred feet of the village property there are several habitations of the poorer class; within 500 feet is the plant of the Block & Pollock Axle Works, which employs about 50 men; and at a distance of about 800 feet is the edge of the built up portion of the village. It is not likely that in the future the territory in the vicinity of the site will be built up, and all things considered it would seem a very desirable site for the location of the purification works. The general surface of the ground on the village property is at elevation 68.7, while low water in the creek is at elevation 56, a difference in elevation of 12.7 feet. It is claimed that the land is never flooded.

The sewage purification works in brief will consist of a pumping station; two sedimentation tanks; a dosing chamber equipped with automatic dosing device; six intermittent sand filters, and one sludge bed.

Memorandum of Plans Submitted. The plans submitted are 16 in number and consist of the following:

Map of village showing location of sewers.
Ten sheets showing details of sewer location and profiles.
Two sheets showing details of flush tanks and manholes.
Two sheets showing details of construction of purification works and pumping station.
One sheet showing possible future extension of purification works.

Pumping Station. In order to obtain the sewage at a sufficiently high elevation for its passage through the purification works, pumping must be resorted to. The pumping station shown on the plans is to be located adjacent to the purification works. The sewage will be brought to the site through one 18-inch sewer at elevation 62.32 and one 10-inch sewer at elevation 56.90. These sewers will be brought together in a manhole, whence the sewage will be diverted to the pumping station. A by-pass connection will also be provided in the manhole, whereby the sewage may be diverted directly to the stream.

The pumping station will consist of a pump well 18 feet in diameter with a total depth of 21.5 feet, surmounted by a reinforced concrete floor and superstructure. The flow line in the well is to be at elevation 56 or 5.5 feet above the bottom, thus giving a storage capacity of 10,500 gallons. In front of the inlet pipe to the well will be constructed a screen chamber 3 feet 6 inches wide, with a maximum depth of flow at the screens of 3 feet 6 inches. The screens are to be in duplicate and made up of ¾-inch round iron bars placed vertically in a frame. The frame will be held in grooves at an angle of 60 degrees with the horizontal. The first screen will have clear openings of ¾ inch and the second screen will have clear openings of ⅜ inch. Steps from the floor above will lead down to the screen chamber, and provision will be made for the admission of light so that the screens will be readily accessible for cleaning.

The sewage is to be pumped by three motor driven centrifugal pumps of the vertical submerged type, each having a capacity of 70 gallons per minute or 100,000 gallons per twenty-four hours. The motors are to be equipped with automatic starting and stopping apparatus so that the pumps will be thrown in and out in accordance with the variation of the sewage flow. The sewage will be raised to elevation 84 or the level of water in the sedimentation tanks, which represents a minimum lift of 28 feet and a maximum lift of 33 feet. The motors and accessories will be placed on the floor at the top of the well in plain view and readily accessible. The arrangement of the pumps and motors will be such that additional units may be installed as needed. The superstructure will consist of a neat brick building 20 feet by 22 feet inside dimensions. The sewage from the pumps will be forced through an 8-inch cast iron pipe having two branches, each leading to one of the two sedimentation tanks. Each branch will be controlled by a gate valve. Before entering the tank proper, the sewage from the pumps will be received into a distributing channel extending along the inlet ends of the tanks, 2 feet wide and about 2 feet average depth to the flow line.

Sedimentation Basins. One of the sedimentation basins is to be 70 feet long, 15 feet wide, and 8 feet deep, representing a capacity of 63,000 gallons, or based on the nominal capacity of the plant, a period of flow of ten hours. The other basin will have the same length and depth but will have a width of 10 feet, representing a capacity of 42,000 gallons, or based on the nominal capacity of the plant, a period of flow of 6.67 hours. There is thus a total sedimentation capacity of 105,000 gallons, or 16.67 hours flow. This capacity is somewhat more than necessary, but with two basins of different size, the period of sedimentation can be modified to suit the quantity of sewage being received at the plant. The sewage entering the basins will be distributed across their width by a series of 6-inch round openings placed 18 inches center to center. Of additional assistance in obtaining this distribution will be a hanging baffle 18 inches in front of the inlet end of the basin. The sewage will be removed from the basin over a long weir having a length equal to about half the width of the basin. Hanging baffles corresponding to those placed at the inlet ends of the basins will also be placed in front of the outlet ends. At two-thirds of the distance between the inlet end and outlet end of each basin will be placed a hanging and a submerged baffle for the purpose of intercepting sludge and thereby preventing this material escaping from the basin. The floors of the basin will be sloped toward the longitudinal center line along which will extend a sludge trough leading to a central point where will be placed a quick opening disc valve giving admission into a sludge pipe leading to the sludge bed.

Dosing Chamber. The dosing chamber will be 26 feet by 28 feet, inside dimensions, and will have a depth of 4.56 feet to the flow line, thus giving it a capacity of 25,400 gallons. This volume distributed over one of the filter beds will cover it to a depth of $2\frac{3}{4}$ inches. The size of this chamber is somewhat larger than altogether desirable but will nevertheless prove quite satisfactory. The dosing chamber will be equipped with alternating discharge siphons (of a type not yet decided upon) which will automatically discharge the contents of the chamber on to the several filters in rotation.

Superstructure. The sedimentation basins and dosing chamber will be covered with a substantially built frame superstructure well lighted and ventilated, which will permit ready accessibility to all parts of this portion of the works.

Filters. There will be 6 sand filters, each 121 feet by 120 feet at the sand line. This represents an area per filter of 14,500 square feet or $\frac{1}{3}$ acre, or a total area of 2 acres. This area allows for a tributary population of 1,000 persons per acre, or expressed differently, allows for a rate of filtration of 75,000 gallons per acre based on the nominal capacity of the plant. The filters will be arranged in 2 rows of 3 each on either side of the sedimentation basins and dosing chamber. The beds will be surrounded by 12-inch concrete walls and the outer walls will be reinforced with earth embankments. The bottoms of the beds will be in natural excavation suitably graded with respect to obtaining an even flow toward the underdrains. The filtering material will consist of 4 feet of sand supported on a layer of gravel. This layer of gravel will have a minimum thickness of 3 inches and a maximum thickness of 6 inches, the latter occurring at the underdrains. The material will be graded from coarse at the underdrains to fine at the surface. The grading of the bottoms of the beds will cause the surface of the gravel to be level. The underdrains will consist of 4-inch vitrified sewer pipe laid transversely across the beds in lines 12 feet center to center. The joints will be left open and carefully surrounded with graded gravel to prevent the entrance of sand. The various laterals will enter a main 10-inch collector extending along the edge of the bed and laid with cemented joints. At the upper end of each underdrain lateral will be placed uprights for inspection, cleaning, and ventilation. On the main collectors from each filter will be placed uprights of sufficient size to permit of obtaining samples of the several filter effluents.

The elevation of the entire plant is such that in constructing the filters but little excavation will be necessary and this small quantity may be used in making embankments. The sewage from the dosing chamber will be distributed upon each bed by a system of vitrified distributing pipes laid with cemented joints and arranged to discharge equal quantities of sewage at 8 points approximately equidistantly placed. To prevent erosion of the sand beds at points of discharge, the same will be protected by slabs of stone. The surface of the sand in the filters is at elevation 75, or $2\frac{1}{2}$ feet below the bottom of the dosing chamber. This gives an ample fall to insure the rapid distribution of sewage to the various filters. The fall, in fact, is really more than necessary. The discharge of the effluent from the filters is at elevation 66, or 10 feet above low water in the creek, and is but 2 feet below the highest known floods. As the underdrains of the filters are somewhat higher than this, it is not likely that floods in the creek will interfere with the operation of the works at any time.

Sludge Bed. A sludge bed will be provided which will be 90 feet by 121 feet at the sand line, representing an area of 10,980 square feet. This bed will be placed at a sufficiently low elevation to receive by gravity the discharge of sludge from the sedimentation basins. The area will permit the reception of the entire contents of the larger sedimentation basin with a depth not to exceed 0.77 foot. The sludge bed will be constructed in all respects similarly to the sand filters.

Future Extension. The purification works will be so placed on the village property as to permit of future extension as needed. This future extension as shown on the plans will consist merely of the duplication of the present proposed installation. On the plans showing possible future extension is indicated a plant having four times the capacity of that about to be built.

Cost. The cost of the purification works is roughly estimated at $20,000; thus the total cost for the proposed improvements will be about $70,000.

The State Board of Health considered the plans for sewerage and sewage purification for Carthage, submitted July 6th, 1909, by Mr. Clinton Cowen, and the same were approved provided:

1st. That plans, in duplicate, for the automatic dosing apparatus be submitted to and receive the approval of the State Board of Health before being installed;

2nd. That samples of all filtering material be submitted to and receive the approval of the State Board of Health before being placed; and,

3rd. That this approval be considered void after August 1st, 1911, unless construction shall have been begun before that date.

REPORT ON PROPOSED SEWERAGE FOR COVINGTON.

On May 1, 1909, an application was made to the State Board of Health by Mr. A. W. Landis of Covington for approval of a proposed system of sewers for that village. The matter was referred to the engineering department and on May 19th, one of the engineering assistants visited Covington for the purpose of making an examination on the ground. The following report was submitted:

Covington is a village of about 2,000 inhabitants and lies in the northwestern portion of Miami County on the East Branch of the Stillwater River at its junction with Greenville Creek. The area of the watershed above Covington is about 450 square miles and the character of the watershed is such that the stream has a fairly even flow throughout the year. Both streams above Covington receive considerable sewage pollution, but no nuisance is created thereby other than at Greenville. At Covington the stream gives no visual evidence of contamination. Below Covington the stream receives more or less contamination but it is at no place used as a source of public water supply. The village lies on rather high undulating ground overlooking the creek valley and is so situated that good drainage is easily obtained.

With the introduction of a public water supply in 1904, the need of an adequate system of sewers became more and more felt.

Until 1906, sewage from the village was discharged into storm water drains and open ditches running through the village. Owing to lack of funds, it was impossible for the village to institute the necessary improvements, and the matter of sewerage was therefore taken up by private individuals. In May, 1906, application was made to the State Board of Health for approval of a partial system of sewers by a company organized for the purpose of constructing same. An investigation of conditions was made and a report submitted by the State Board of Health engineering department, upon the strength of which the Board voted to approve the system upon the following conditions:

> "1st. That definite plans and specifications be submitted later for approval by this Board and that these plans and specifications provide that the outlet be located at such point that the sewage, from the entire village can, when necessary, be drained to it;
>
> 2nd. That this outlet be located at least 150 feet below the emergency intake of the village water-works;
>
> 3rd. That the main sewer be of such a grade that it can be easily continued to a proper site for a sewage purification works in the future; and,
>
> 4th. That sewage purification works, of a design satisfactory to the State Board of Health, be installed and placed in operation whenever this is deemed necessary by said Board."

The above conditions have all been duly carried out.

The additional sewers now proposed are also to be installed by private parties if approved. The proposed sewers are intended to supplement those already installed but are to remove the sewage from a more southerly portion of the village. They are so designed that the main sewer may ultimately be connected with the existing sewers for the purpose of conveying all of the sewage to a suitable site for purification works. The complete system of present proposed sewers will comprise 1,870 feet of 8-inch vitrified sewer pipe and 7,200 feet of 6-inch vitrified sewer pipe. Immediate installation, however, includes but 1,900 feet of the 6-inch pipe and the cost of immediate installation is estimated at $1,200. The sewers are to be carefully laid with cemented joints and in general accordance with approved practice, with the exception, however, that it is proposed to use for the most part lampholes in place of manholes. It is not believed that this arrangement will give entire satisfaction and it is recommended that manholes be placed at all changes of direction and grade in order that the sewers may be more readily accessible for cleaning and repairs.

It is expected that a population of 75 will be connected with the sewers as soon as completed and that within a year 130 persons will be tributary. It is not anticipated that more than 3,000 persons will at any time use the sewers. It is intended that the sewers shall be used strictly for sanitary purposes, though cellar drains may be connected with them. This is perfectly legitimate, provided subsurface drains and downspouts are not permitted to discharge into cellar drains.

It is appreciated by the village authorities and those proposing to install the sewers, that sewage purification will ultimately be necessary, but that for at least a number of years the amount of sewage reaching the stream will not be so great as to create a nuisance or even objectionable visible effects upon the stream. The proposed outlet is to be of temporary character and will enter the Stillwater River at the foot of Bridge Street. As shown on plans submitted, the outlet will be carried well into the stream so as to avoid objectionable deposits on the banks. The point of discharge is over a thousand feet below the water works emergency intake and there is no possibility of the sewage backing up over the intake.

June 7th, 1909, the Board approved the plans for proposed sewerage for Covington provided:

1st. That sewage purification works of a design satisfactory to the State Board of Health be installed and placed in operation at the end of a period of three years from date of approval.

2nd. That the main sewer be of such grade that it can be easily continued to a proper site for sewage purification works in the future.

3rd. That suitable manholes be installed at all changes of grade and direction, and that in no case shall there be a greater distance than 400 feet between manholes.

4th. That this approval be void after June 1st, 1911, unless construction of the sewers is commenced before that date.

SUPPLEMENTARY REPORT ON SEWERAGE AT ELMORE.

At a meeting of the State Board of Health held January 20, 1909, the report on sewerage at Elmore, previously made by a special committee, was referred to the chief engineer for further investigation. The following report was submitted:

On September 25, 1908, there was received from Mr. Frank E. Holtcamp, clerk of the board of health of Elmore, a petition under the Bense Act, asking that the State Board of Health investigate the discharge of sewage into the Portage River and require the village of Elmore to properly dispose of such sewage.

A committee consisting of Dr. Chapman, member, and the chief engineer, visited Elmore November 6, 1908, and made an investigation. This investigation showed that there were four principal outlets through which sewage was being discharged, or about to be discharged, into the Portage River. The principal one of these outlets was that at Toledo Street. This outlet was constructed previous to 1893, when the State Board of Health first had jurisdiction in such matters. The other outlets have all been installed since 1893, but without the approval of the State Board of Health. The most recent of these outlets, that in Cheapside Street, was constructed last fall and has lately been placed in service.

It is probable that the primary cause of complaint on the part of the board of health of Elmore is due to the inadequate flushing of existing sewers. These sewers were originally intended for storm water only, but have been used for domestic wastes and sewage. For several years in the past, foul odors have been caused by deposits in these sewers, such odors arising into the streets and houses and creating objectionable and unhealthful conditions. Attempts at providing water for flushing by using the rain water in a fire cistern, proved inadequate. In spite of these conditions, however, the village authorities, on account of lack of co-operation on the part of the citizens, have never been able to provide a public water supply.

In addition to the nuisance outlined above, the Portage River, or at least one channel thereof, was found to be badly polluted at the time of inspection. This pollution, however, could have been remedied somewhat, at least in the case of the Toledo Street outlet, by effecting a more thorough mixture of the sewage with the river water and preventing the sewage from spreading out over the banks of the stream.

The committee appointed to investigate the above conditions submitted two reports. The first report made in answer to the Bense Act petition submitted by the local board of health, dealt with the Toledo Street sewer which was the source of greatest complaint both as regards the creation of odors in the village and in respect to the pollution of the stream. The summary of this report was as follows:

> "The sewers of Elmore are unsuited for sanitary purposes unless a public water supply is installed. The discharge of sewage into the Portage River has the effect of badly polluting that stream and interfering with the health and comfort of those living near its banks or passing across the stream.
>
> With the exception of the Toledo Street sewer, all of the sewers in Elmore have been built illegally in that plans therefor have never been submitted to the State Board of Health for approval.
>
> As a solution of the problem, an intercepting sewer should be built from Ottawa Street eastward to a point below the cemetery, and the sewage there purified.
>
> There is now before the Board a report on a 'proposed sewer' (which has just been completed) in Cheapside Street. It would be desirable to give the local officials time to conform to the action of the Board on this last proposition before action is taken under the Bense Act."

The second report related to the sewer known as the Cheapside

Street sewer which was at the time of inspection barely completed and which was therefore considered by the committee as a proposed sewer.

At the meeting of the State Board of Health on December 9, 1908, the above two reports were considered, and the Board found from the report made under the provisions of the Bense Act that the Portage River at and below Elmore was polluted; and the secretary was instructed to notify the authorities of Elmore of the above findings and to give them an opportunity to be heard at the meeting of the Board on January 20, 1909, and show cause why said village should not be required to purify its sewage. The Board at this meeting, after considering the second report, voted to disapprove the proposed Cheapside Street sewer, "unless, first, there be provided a suitable water supply for flushing said sewer; and second, that there be constructed an intercepting sewer to convey the dry weather flow from this and all other outlets to a point below the cemetery where the sewage shall be purified in a manner satisfactory to the State Board of Health."

A delegation from Elmore appeared before the Board at its meeting on January 20, 1909, and made argument against purifying the sewage. It was stated by these officials that in their opinion a channel could be cut through the limestone bed of the stream in such a manner as to convey the sewage from the Toledo Street outlet into the current at all times. The Board after hearing this argument, referred the matter to the chief engineer for further investigation and report.

With respect to solving the problem by cutting a channel through the bed of the stream, it is believed that this will not be an entirely satisfactory solution, although it will improve conditions as far as the residents of Elmore, who through their board of health, are the complainants, are concerned.

With respect to the sewer in Cheapside Street as well as those known as the Augusta and Fremont Street sewers, none of which has been approved by the State Board of Health, it would seem that these sewers should not be used until adequate means for flushing them have been provided.

SUMMARY.

Objectionable and unhealthful conditions have been found to exist at Elmore due to the improper construction and maintenance of the existing sewers.

All of these sewers with the exception of those discharging through the Toledo Street outlet, have been built since the year 1893 but have never been approved by the State Board of Health as required by law. The Portage River below Elmore was at the time of inspection badly polluted by the sewage discharged at the Toledo Street outlet. The Cheapside Street sewer has been definitely disapproved by the State Board of Health.

In order to satisfactorily solve the problem of sewerage and remedy the conditions complained of, there should be provided, first, a public water supply, and second, an intercepting sewer to convey the dry weather flow from all outlets to a point below the village.

At a meeting of the State Board of Health held June 16th, 1909, the Board voted to condemn the sewers known as the Cheapside Street sewer, the Augusta Street sewer, and the Fremont Street sewer, and that all connections with such sewers be ordered cut off until such time as a system of water works, or other adequate means of flushing said sewers, be provided; that permission be given to construct a channel, as proposed by Elmore officials, in the bed of the Portage River to convey sewage below the village, and that the installation of a sewage purification plant be postponed until it could be ascertained whether this arrangement would sufficiently improve conditions complained of, and make such plant unnecessary at the present time.

The authorities were notified that council would be expected to take the necessary action to prohibit the use of the sewers named until some proper provision could be made for flushing the same.

REPORT ON PROPOSED SEWERAGE AND SEWAGE PURIFICATION FOR ELMWOOD PLACE.

On October 1, 1909, there were received from Mr. E. J. Heckle of Cincinnati, consulting engineer for Elmwood Place, a set of plans for sewerage and sewage purification for that village. Preceding the receipt of plans, there were held two conferences between the consulting engineer and the acting chief engineer of the Board, during which informal advice was given. The following report of the engineering department was submitted:

Elmwood Place is located about one and one-half miles to the northward of the northernmost city limits of Cincinnati and in the valley of Mill Creek. The present population is estimated at about 3000 and growth of the village is moderate. Within the corporation limits there is an area of about three-fourths square mile. This entire area lies in the nearly level bottom lands of Mill Creek which consist of deep glacial deposits of clay, sand and gravel, filling the old glacial valley. The gravel deposits are abundantly waterbearing and form the source of public water supply for Elmwood Place and its neighboring village of Carthage.

Elmwood Place contains several important manufacturing establishments which constitute the principal support of the village and among which may be enumerated the Laidlow-Dun-Gordon Pump Company, employing 300 men; the Stacy Manufacturing Company, manufacturers of steel plate and miscellaneous iron work, employing 200 men; and the Highland Buggy Company, employing about 50 men. There are also other concerns of minor importance.

As might be supposed from the nature of the industries, mechanics and skilled workmen form the dominant class of the population. The houses are for the most part modest but generally equipped with modern conveniences including plumbing.

There are in all about seven miles of streets, but probably not over two miles of these are paved. The village as a whole presents a well kept and clean appearance.

At the present time Elmwood Place has no system of sewers, though there are a number of private drains. With the more extensive use of modern plumbing, the need of an adequate sewerage system has been strongly felt. The likelihood of early annexation to the city of Cincinnati, in which event the bonded indebtedness of the village will be assumed by the city, affords an opportune time in the eyes of the citizens of Elmwood Place, to build a complete sewerage system to meet all needs of the village for some years to come.

The plans submitted provide for a system of sewers to be built on the separate plan and sewage treatment works for the sanitary sewage. Following is a detailed description of these plans.

SEWERS.

The present plans call for sanitary sewers only, it being assumed that storm sewers may be constructed wherever and whenever needed. The sewers will range in size from 8 inches in diameter to 18 inches in diameter; the length of each size is exhibited in the following table:

Size pipe	8-inch.	10-inch.	12-inch.	15-inch.	18-inch.
Feet	13,378	6,886	4,248	945	1,691
Miles	2.34	1.30	.81	.17	.32

Total, 4.94 miles.
85 manholes; 37 flush tanks.

All sewers will be of vitrified sewer pipe laid with cemented joints. Standard construction will be observed throughout; manholes will be placed at intervals not exceeding 400 feet and at all changes of grade and direction; automatic flush tanks will be placed at all dead ends; and where necessary the sewers will be underdrained. Owing to the local topography, the grades are not all that can be desired, and it has been found necessary to use a minimum grade of 0.3 per cent. In the case of Elmwood Place, the matter that needs to be most emphasized is the exclusion of ground water which is likely to be encountered in great quantities. To this end the joints should be made with special care and liberal underdrainage provided. It is thought that a maximum of 5000 gallons per day per mile of sewers should be an acceptable minimum, though conditions may be found which will render necessary the acceptance of a higher minimum.

FLOW OF SEWAGE.

Before going on to a consideration of the purification works, it will be advisable to consider the probable flow of sewage. As already stated, the total population is probably 3000 and the growth is but slight. It is not likely that within the next ten years there will be a population tributary to the sewers exceeding 2000. This would therefore serve as a basis in determining the nominal capacity of the purification plant. While the water consumption will probably not exceed 75 gallons per capita, the sewage flow owing to presence of ground water will probably reach at least 100 gallons per capita.

PURIFICATION WORKS.

Site. The site for the purification works is rather favorable in that it lies in a naturally unfrequented place between the C. H. & D. Railroad tracks and Mill Creek. It is somewhat nearer to habitations and other buildings than is altogether desirable, but it is effectually screened from these by high railroad embankments. The elevation is such that the works will never be flooded, though the water in the creek may rise to an elevation somewhat above the underdrains of the filters. The sewage flow from all parts of the village may be conducted to the site by gravity and will be conveyed in an 18-inch main trunk sewer.

General Features. The devices included in the purification works comprise a screen chamber; two sedimentation tanks; a dosing chamber automatically operated; six intermittent sand filters; and a sludge bed.

Screen Chamber. The screen chamber as shown on the plans is a rectangular concrete structure 14 feet long, 4 feet wide, and 2 feet 6 inches deep, with a depth of flow of about one foot. It contains two removable screens inclined toward the inflowing sewage and making an angle with the horizontal of about 60 degrees. The first screen is shown as having a mesh of ¾-inch clear openings, and the second as having ½-inch clear openings. The mesh screen is decidedly undesirable and should be changed for screens made up of vertical bars. The screen chamber is covered with a removable iron grating. The flow of sewage from the screen chamber will be controlled by suitably placed gates connecting with channels leading to the sedimentation tanks.

Sedimentation Tanks. There are shown on the plans two sedimentation tanks. One of these is 66 feet long, 7 feet deep to the normal flow line, and 15 feet in width; thus having a capacity of 52.000 gallons or 6½ hours flow based on a nominal capacity for the plant of 200,000 gallons per day. The other tank has the same length and depth but the width is 7 feet; it thus has a capacity of 24.200 gallons or 2.9

hours flow. It will be seen that sedimentation periods of 3 hours, 6½ hours, and 9½ hours can be had. When the plant is first placed in operation, the use of the small tank alone will probably suffice.

From the inlet channel, which extends along the upper ends of the tanks, the sewage will be admitted through a series of rectangular openings spaced equidistantly across the width of the tanks. These openings are 6 inches wide and 18 inches high and are placed just below the flow line. In the larger tank there are nine openings, and in the smaller tank there are five. Placed 2 feet beyond the inlet of each tank is a hanging concrete baffle extending to a depth of 4 feet below the surface of the liquid. Two feet in front of the outlet ends of the tanks is a similar baffle. The sewage is drawn from the tanks over adjustable weirs extending across the entire width of the tanks into a collecting channel from which the liquid is conveyed to the dosing chamber. At three-fourths of the distance from inlet to the outlet end of each tank is placed a pair of concrete baffles, one hanging, the other submerged for the purpose of intercepting sludge and scum and thereby creating a sort of secondary tank just in front of the outlet where no violent action is likely to occur. The bottoms of the tanks are drained to a central point from which the sludge may be removed through suitable pipe connections. The valves controlling these connections are placed in a manhole at one side of the tanks.

For the purpose of preventing as far as possible the dissemination of odors, the tanks are covered with reinforced concrete slab roofs. Over the inlets, outlets and sludge drains, the roofs are provided with ample openings permitting of ready accessibility. Manholes will also be placed at intermediate points.

Dosing Chamber. The dosing chamber, which is shown in the center of the group of filters, is 50 feet long, 12 feet wide, and about 3 feet deep to the flow line. One end of the chamber is circular to accommodate a circular superstructure. The capacity of the chamber based on the above dimensions is 13,500 gallons, which will cover one filter bed with an area of ⅓ acre to a depth of 1.5 inches. The size of the dosing tank should be nearly doubled. That portion of the dosing chamber not under the superstructure is covered with reinforced concrete slab construction. The superstructure is shown as a neat circular buff colored brick building with a conical tile roof. The type of automatic dosing apparatus which will be placed under the superstructure has not as yet been decided on.

Intermittent Sand Filters. The plans show six intermittent sand filters arranged in two rows of three each. Each filter is 100 feet by 110 feet at the sand line. This represents an area of 11,000 square feet or slightly over ¼ acre. The total area is therefore but a little over 1½ acres. It is not believed that this area is sufficient for a nominal capacity of 2000 persons tributary and fully two acres should be insisted upon.

The filtering material will consist of a bed of clean sand underlaid by 9 inches of graded gravel. It is expected that samples of filtering material will be submitted after the contracts are let.

The filters will be underdrained by lines of 6-inch vitrified sewer pipe 15 feet from center to center and laid with open joints. An improvement in the design can be effected by grading the surface of the bottoms of the filters toward the underdrains. Eight-inch main drains will lead from each filter and join a 10-inch main drain for all the filters. All main drains will be made of vitrified sewer pipe with cemented joints, and manholes will be placed at their intersections. Distribution of sewage on the surface of the beds will be effected by a system of wooden troughs discharging at four points approximately equidistantly spaced on the surface of each filter. Erosion of the sand will be prevented by concrete slabs placed at the points of discharge. The troughs shown on drawing are not large enough.

Wide and substantially constructed embankments with sodded slopes are shown between the filters.

Sludge Bed. For treating the sludge which must occasionally be discharged from the sedimentation tanks, there is shown a sludge bed 90 feet long and 80 feet wide at the sand line. The area thus provided will take the entire discharge of the larger tank with a depth of flow of a little less than one foot.

At a meeting of the Board held October 13th, 1909, the plans of Mr. E. J. Heckle, consulting engineer, submitted October 1st, 1909, were approved, the site for the purification works to be on the west side of Mill Creek, opposite Elmwood Place, at least 700 feet from the nearest house and over 500 feet from the Cincinnati, Hamilton and Dayton Railroad, provided plans with changes as agreed to by the engineer, Mr. Heckle, are filed with the State Board of Health.

REPORT ON PLANS FOR A SEWAGE PUMPING STATION AND THE CONSTRUCTION OF LATERAL SEWERS FOR THE VILLAGE OF JACKSON.

On June 3, 1909, there was received from Mr. J. W. Turner, a communication requesting the approval of a certain portion of the plans which had been submitted to the State Board of Health on May 6, 1909. This communication was referred to the engineering department and the following report submitted:

The village of Jackson is in Jackson County. Salt Creek, a stream which has a watershed of some 25 square miles, flows through the village. The average dry weather flow of this stream is very small and at times the stream bed is entirely dry. According to local estimates based on the last election, the population of the village is now about 7,000.

Previous Plans for Sewerage and Sewage Purification. In 1901 plans for a system of sanitary sewers for Jackson were approved by the State Board of Health, provided sewage purification works were constructed prior to the use of the sewers. Up to 1904 no sewers were built.

In 1904 the Board was called upon to approve the plans for the purification of the Jackson sewage. The proposed treatment included septic tanks, followed by aeration and intermittent filtration through eight filters constructed of slag variously graded. These plans were approved on March 22, 1904, on condition that samples of the filtering material satisfactory to the Board be submitted before the plant was built. The Board also suggested changes in certain other details of the filters. This plant was never constructed.

The village engineer visited Columbus on January 29, 1909, with reference to new plans for sewage purification for the village. It was learned at this conference that there now exist in the village about three miles of trunk sewer, which consists of 8, 12, 15, 18 and 24-inch pipe. It was stated that the main sewer was extended about 1,500 feet farther west than was shown on the plans approved by the Board in 1901. It was stated that as yet no laterals have been built.

Complete plans for sewage purification, including a pumping plant, were submitted on May 6, 1909.

Present Proposed Construction. As set forth in a communication received from the village of Jackson on June 3, 1909, and abstracted below, the village desires to construct during the present year a sewage pumping station and about three miles of lateral sewers, omitting the sewage purification plant. The communication is in brief as follows:

1. About three miles of a trunk sewer have been constructed and beginning November, 1909, about twelve house connections may be expected.

2. The funds available for 1909 are $16,000 and a similar amount in 1910. The estimated cost to complete the main sewer and to construct a pumping station is $6,000, leaving a balance of $10,000. It is desired to build this year about three miles of lateral sewers, to which there will be accessible about 150 dwellings; that is, beginning November, 1909, perhaps 100 houses will be connected to the entire sanitary sewer system.

3. Were a purification plant constructed at present, before the

lateral sewers are built, the plant would be operated for perhaps one year with not more than twelve house connections.

4. It is, therefore, deemed expedient to construct the pumping station and three miles of lateral sewers to be completed by November, 1909, followed by the sewage purification plant in the spring of 1910.

5. From November, 1909, to perhaps August or September, 1910, the sewage from about 112 house connections would be discharged into Salt Creek unpurified. It is to be noted that low water does not occur in Salt Creek until September, at the earliest, and that during the winter and spring the available dilution is very great.

6. In view of all these facts approval of the above project is desired.

Proposed Plans. Present plans contemplate the construction of a pump well and pumps and about three miles of lateral sewers. These sewers have already been approved by the Board.

The pumping station is to be located in the northerly part of the village at some distance from the main residential section. Sewage from the 24-inch main sewer flows into a concrete pump well 20 feet in diameter and 18 feet deep, with a working capacity of about 23,500 gallons.

The sewage is to be screened by a rectangular basket 3 feet by 4 feet in plan and 2½ feet deep constructed of iron bars with an open space of about ¾ inch. The screen basket is counter-weighted and may readily be removed for cleaning.

The pumping plant consists of duplicate 4-inch centrifugal pumps operated by vertical electric motors. The motors are automatically started by floats when the sewage in the well reaches the flow line. The pumps and motors are housed by a slate roof concrete and brick structure 6 feet 8 inches by 10 feet 8 inches in plan and 8 feet high.

At a meeting of the State Board of Health held on June 17th, 1909, the plan to construct three miles of lateral sewers, approved in 1901, and the pumping station shown on plans submitted on May 6th, 1909, were approved provided:

1st. That plans for a sewage purification plant be submitted to the Board for approval not later than December 1st, 1909, and that construction of the sewage purification plant be begun not later than April 15th, 1910;

2nd. That records be kept of all taps into the sanitary sewers;

3rd. That present connections to storm sewers be removed, and that further connections to same be strictly prohibited; and,

4th. That this approval be void after December 1st, 1909, unless construction of the pumping station and lateral sewers is commenced before that date.

REPORT ON PROPOSED SEWERAGE AND SEWAGE PURIFICATION FOR JEFFERSON.

On May 6, 1909, plans were submitted by Mr. E. J. Crisp of Elyria, consulting engineer for Jefferson, for a system of sanitary sewers and sewage purification works for that village. This was followed by correspondence with the engineering department relative to the feasibility of utilizing for village purposes an existing sewage purification plant built by the county and serving the court house and jail. As a result of this correspondence, the consulting engineer became convinced that the best proposition for the village was to construct a new sewage purification plant as originally planned and as this opinion seemed to be shared by the majority of citizens of Jefferson, the following report dealt with the original proposition:

Jefferson is the county seat of Ashtabula County and lies near the geographic center of that county on a small tributary of Mill Creek which in turn is tributary to Grand River. The population at the present time is estimated to be in the neighborhood of 1,300. The villagers are composed principally of retired farmers and there are no manufacturing industries of any importance, so that Jefferson is essentially a rural community. For this reason the growth has been very slow and the probability of future material growth is not great.

Jefferson is an unusually attractive village and has a great number of well paved sidewalks and well kept dirt and macadam roadways. A public water supply derived from Mill Creek and purified by a mechanical filtration plant has recently been installed. The filtration plant seems to produce a highly satisfactory effluent as evidenced by analyses submitted to the State Board of Health. The introduction of the public water supply together with modern pumping which is thereby made possible, has given rise to the necessity for an adequate system of sewers. Jefferson is fortunately situated for the construction of sewers, as the branch of Mill Creek upon which it lies flows through a deep ravine which permits of ample fall and the construction of sewage purification works without the necessity of pumping the sewage. Also the absence of paved streets at the present time will facilitate and cheapen the construction of the sewers.

BRIEF DESCRIPTION OF PROPOSED PLANS.

In brief, the plans show a complete system of sanitary sewers which will convey all the domestic sewage including cellar drainage to the northwestern part of the village in the valley of the above mentioned small creek to the site of the sewage purification works. The purification works comprise screening, sedimentation, and filtration through intermittent sand filters. The devices include a screen chamber, two sedimentation tanks, one dosing chamber, one siphon chamber, four sand filters (but three of which are proposed for present installation), and one sludge bed.

Sewers. The area of the sewer district is 450 acres, or roughly, somewhat less than half of the area included within the corporation limits. The sewer district, however, includes practically all of the built up portion of the village with 90 per cent of the population. The present installation of sewers includes a total of about 7.87 miles divided as follows:

8-inch vitrified sewer pipe	29,983 feet.
10-inch vitrified sewer pipe	7,100 feet.
12-inch vitrified sewer pipe	3,930 feet.
8-inch cast iron sewer pipe	283 feet.
10-inch cast iron sewer pipe	336 feet.
Total	41,632 feet = 7.87 miles.

The plans show for the completed system 9.06 miles of sewers which it is anticipated will care for an ultimate population of 10,000. The above figure, however, does not represent the limit to which the sewers may be extended.

The sewage will be conducted to the purification works through two main sewers, respectively 9 and 10 inches in diameter. All vitrified pipe sewers will be laid with cemented joints covered with cloth or tar. Manholes will be placed at all changes of grade and direction and no greater distance will be permitted between manholes than 700 feet. The ordinary distance between manholes will be 460 feet. Flush tanks will be placed at all dead ends and will contribute about 10,000 gallons daily, or normally one-tenth of the sewage flow. Where sewers cross ravines and watercourses or are under pressure, they will be made of cast iron pipe. The sewerage system will be ventilated through house connections and perforated manholes. Wherever ground water is encountered in considerable quantities, the sewers will be properly underdrained. On the whole, the design of the sewerage system is in accordance with good practice and with good workmanship should prove satisfactory.

Quantity of Sewage to be Treated. It is estimated that within the next five or six years about 1,000 persons will be tributary to the sewers and that purification works for present installation based on this population should prove adequate. This would be figuring rather closely were it not for the fact that the population is increasing slowly. Assuming a sewage flow of 100 gallons per capita, which is a liberal estimate, the total sewage flow would be in the neighborhood of 100,000 gallons per twenty-four hours.

SEWAGE PURIFICATION WORKS.

Site. The site chosen for the location of the purification works is as already noted in the northwestern part of the village in the ravine of the small creek passing through the northern part of the corporation. The creek generally has but a small flow and during prolonged periods of dry weather has no flow at all. As shown on the plans, the works will be about 250 feet distant from the county fair grounds and 400 feet distant from the nearest dwelling. There are but very few dwellings within 1,000 feet of the site. The locality is secluded and should prove entirely satisfactory in this respect. The disadvantages of the site are the roughness of the topography which will render considerable costly grading necessary, and the liability to settlement of that portion of the plant which must be built on fill. Another objection which may be raised is the comparative inaccessibility of the site which may promote laxity on the part of the caretakers. The elevation of the site is such that the purification works will not be affected by high water in the creek; in fact, the outlet of the underdrains to the filters will be fully 4 feet above high water and 6 feet above low water. It will appear that the fluctuations in the creek level are not great. On the whole, the site must be considered a favorable one.

Screen Chamber. The two main sewers from the village unite in a manhole near the purification works and thence the sewage flows through a short 12-inch pipe to the screen chamber. This chamber is 2 feet 4 inches wide, 7 feet 10 inches long, and 5 feet in depth to the flow line. There are two screens which are made up of rectangular iron bars with $1\frac{1}{8}$-inch open spaces. These screens are placed opposite each other and inclined so as to form a V-shaped compartment between them. The bottoms of the screens are supported upon a concrete shelf across the chamber and about 18 inches below the flow line. The sewage in entering the screen chamber will be compelled to flow in a generally upward direction through the screen into the V-shaped compartment formed by the screens and the supporting shelf, and thence into the sedimentation basins. This arrangement is not satisfactory inasmuch as it permits an accumulation of solid matter in the screen chamber which cannot be readily removed. This being a comparatively unimportant matter, it is not deemed advisable to withhold approval because of it, but before construction is begun a design should be submitted satisfactory to the engineer of the State Board of Health.

Sedimentation Tanks. The plans show two sedimentation tanks each having a capacity of 18,000 gallons or a total capacity of 36,000 gallons. representing an approximate average flow period of eight hours. The general dimensions of each of these tanks is length 32 feet, width 14 feet, and depth to flow line 6 feet. Each tank is divided into four compartments by 8-inch walls with openings so placed that the sewage must find its way through the tank by a zigzag course. Near the outlet of each tank is placed a hanging baffle for the purpose of holding back scum and producing an even flow across the width of the tank. An adjustable weir constitutes the outlet of each tank over which the sewage will fall into a trough leading to the dosing chamber. The plans do not call for the covering of the sedimentation tanks. Covers would be advisable for the purpose of rendering the plant more sightly and for preventing the dissemination of disagreeable odors. Owing to the secluded location of the plant, it might be permissible to omit the covers provided it is understood that the covers will be built if found desirable later on. The sedimentation tanks are drained by a suitable system of sludge drains leading to the sludge bed.

Dosing Chamber. The dosing chamber has a capacity of 18,000 gallons, a sufficient quantity to cover one filter bed to a depth of 2 inches. The general dimensions of the dosing chamber are 31 feet by 31 feet in plan and 2½ feet average depth to the flow line. Leading from the bottom of the dosing chamber will be a 14-inch cast iron pipe extending a distance of about 200 feet to a so-called siphon chamber centrally located with respect to the filters, which will contain the automatic dosing apparatus. The siphon chamber is a small tank about 8 feet square, inside dimensions, and about 5 feet in depth to the flow line. It is surmounted by a substantially constructed and well lighted superstructure. Space is available for the installation of four automatic alternating siphons, but only three are to be included in the present equipment since but three of the filters are to be built. The type of dosing apparatus has not as yet been decided upon but it is understood that plans will be submitted for the approval of the State Board of Health as soon as a decision is made. The dosing chamber as well as the sedimentation tanks is to be left uncovered and the same remarks made in connection with the sedimentation tanks apply also in this instance.

Filters. The plans show four intermittent sand filters, of irregular shape in order to conform to the topography of the site, each of which has an area of ⅓ acre. It is proposed to build but three filters as a present installation which will make a total area of one acre. This area represents a population tributary of 1,000 persons per acre and a rate of filtration of 100,000 gallons per acre per day. The filters are to be built partly in fill and partly in excavation and will be separated from each other by means of embankments 18 inches in height. The filtering material will consist of 3 feet of Lake Erie sand underlaid by 6 inches of Lake Erie gravel. Each bed will be adequately underdrained. The lateral drains will be of 3-inch pipe spaced 24 feet center to center and these will be tributary to a main central drain varying in size from

4 to 8 inches in diameter. The main underdrain from each filter will discharge directly into the creek. The material of which the underdrains is to be made is not stated but vitrified pipe with bell and spigot ends should be required. The sewage will be distributed on to the surface of the filters by means of a system of wooden distributing troughs. The details of design of these troughs are not shown; such details can be adjusted by conference of the engineer of the State Board of Health and the consulting engineer. The plans do not indicate that the embankments and slopes caused by grading are to be sodded. In order to protect the surface of the filters from storm wash and to render the slopes more permanent, sodding is essential and should be required.

Sludge Bed. A sludge bed is provided which may be reached by gravity from the bottom of the sedimentation tanks. An area of 2,590 square feet is provided which would be covered to a depth of about 11 inches when receiving the entire contents of the sedimentation tanks. In all essentials the sludge bed is constructed in the same manner as the sand filters.

COST.

The estimated cost of the sewers to be included in the first installation is $29,000. The estimated cost of the purification works is $21,000.

September 7th, 1909, the State Board of Health approved these plans for proposed sewerage and sewage purification for Jefferson, submitted May 6th, 1909, by Mr. E. J. Crisp of Elyria, consulting engineer, upon the following conditions:

1st. That three beds may be built as a present installation provided it is understood that the fourth bed will be added when the sewage flow exceeds an average rate of 100,000 gallons per twenty-four hours;

2nd. That the sedimentation tanks and dosing chamber will be covered in a satisfactory manner if at any time such cover in the opinion of the State Board of Health becomes advisable;

3rd. That detailed drawings of the automatic apparatus and samples of all filtering material be submitted to and receive the approval of the engineer of the State Board of Health before being put in place;

4th. That details of design of the screen chamber, underdrains of filters, and distributing troughs on surface of filters, be modified to the satisfaction of the engineer of the State Board of Health before construction is begun;

5th. That all exposed slopes and embankments be carefully sodded before any filtering material is put in place; and,

6th. That this approval be considered void unless construction shall have been begun by August 1st, 1910.

REPORT ON PROPOSED STORM SEWERAGE FOR LINDEN HEIGHTS.

On March 15, 1909, plans were submitted for a system of storm sewers for the village of Linden Heights, Franklin County, by Messrs. Bradbury and Shute of Columbus, consulting engineers. These plans were referred to the engineering department and were reported on as follows:

The village of Linden Heights is a new suburb of Columbus and lies to the north of that city. The population at the present time is very small but it is anticipated that in the course of four or five years the population will be about 800. The area within the corporation limits is 225 acres, and the topography within the village and also in the immediately surrounding country is quite flat. It is desired to build a system of storm sewers at the present time preliminary to street paving.

Natural drainage of the village is in two directions. About 30 acres in the western part of the village drains to the southwestward, the drainage ultimately finding its way into the Olentangy River about two miles distant. The remainder of the area within the corporation limits drains to the southeastward, the drainage ultimately finding its way into Alum Creek about one mile distant. The proposed sewers are divided into six so-called systems. One of these systems drains the 30 acres in the western portion of the village into the valley of the Olentangy River. The other five systems cover the remaining portion of the town and discharge through three outlets into nearby drainage ditches which after a flow of a mile or more, discharge into Alum Creek. Owing to the general flatness of the topography, all of the sewers must be laid at quite shallow depths. The minimum depth which will be used is about 2½ feet and the maximum about 5 feet. These shallow depths have an advantage in that they will effectively prevent the use of the sewers for cellar drainage and will render their use for sanitary wastes unlikely.

The total cost for the entire system is estimated at $35,228.

It is understood that the sewers are to be built in general conformity with best practice, with the exception that smaller grades than are ordinarily considered proper must be used; and further, owing to lack of funds, it has been necessary to figure rather closely on the size of the main sewers.

These plans were considered by the Board at its meeting held April 22nd, 1909, and were approved provided:

1st. That the village council pass and file with the State Board of Health an ordinance forbidding the tapping of all sewers shown on plans submitted and any future sewers tributary thereto, for the purpose of admitting water closet wastes, sink drainage, or household wastes of any kind.

2nd. That this approval be void after May 1st, 1910, unless construction of the sewers is commenced before that date.

REPORT ON PROPOSED SEWERAGE AND SEWAGE PURIFICATION FOR LOUISVILLE.

On October 6, 1908, there were submitted, by Mr. F. E. Myers of Canton, consulting engineer for the village of Louisville, plans for proposed sewerage and sewage purification for that village. These plans were informally criticised by the engineering department and as a result were again submitted on January 16 and March 7, 1909. On March 27, 1909, one of the assistant engineers visited Louisville and investigated the conditions relating to the proposed plans. On April 7, 1909, the consulting engineer submitted revised plans. These plans were referred to the engineering department and the following report was made:

The village of Louisville with a total population estimated from the census reports at 2,000, is in the northeasterly part of Stark County and lies on an area of about 334 acres which drains into the east fork of Nimishillen Creek. This stream at this point has a watershed of about five square miles and branches three times within the corporation limits. While there are no accurate records available, it is probable that the dry weather flow is not more than 3 to 5 second-feet. The stream is at present polluted by some domestic sewage which is discharged into two existing storm water sewers in Louisville. At Canton, eight miles distant, the east fork of Nimishillen Creek is grossly polluted by acid iron wastes and it also receives some domestic sewage. In order to prevent a local nuisance, the engineer employed by the village in considering the construction of a system of sanitary sewers, contemplates the treatment of the sewage at a purification plant.

Proposed Sewerage. Natural topography divides the village into two districts with reference to sewerage, namely, a high level and a low level district. The sewerage of the village as planned provides for the interception of sewage from both of these districts; the high level sewage will reach the purification plant by gravity, but that from the low level district must be pumped.

The sewerage system is to comprise 21,215 linear feet of 8-inch pipe, 3,920 linear feet of 10-inch pipe, and 16,000 linear feet of 12-inch pipe, which lead directly to the sewage purification plant. The sewerage system for the high level district is estimated to be adequate for five years, and the quantity of sewage for which it is designed is estimated at 140,000 gallons in twenty-four hours based upon a tributary population of 2,000 and a water consumption of 70 gallons per capita. The number of persons expected to use the sewers immediately is 1,000, and the quantity of sewage 70,000 gallons in twenty-four hours. It is expected that the immediate connections will number about 280, including five factories, one hotel, 26 stores, and 248 one-family houses. Cellar drains will be connected and the system is to be designed with manholes and flush tanks. The sewers are not to be underdrained unless there be encountered in construction an unsuspected volume of ground water.

Proposed Sewage Purification Plant. The sewage purification plant is to be located on a 6-acre tract of land in the southwesterly part of the village adjoining the bottom land of the east branch of Nimishillen Creek. Approximately three acres of this land, near the creek, is below freshet level; the remainder, however, rises rapidly to an elevation of possibly 25 feet above the creek. The plant is to be located in part on this higher land and in part on the lower land after raising the elevation of the latter to a suitable height. The plant as proposed, therefore, will be above flood level.

The plant is designed to treat the sewage from a population of 1,000 persons at least. With proper care, it would probably accommodate more than this number. At 70 gallons per capita daily, the total flow would be 70,000 gallons per day. The method of purification proposed is (a) screening; (b) sedimentation in tanks which may be operated on the septic plan; (c) a dosing tank; and (d) filters of sand or gravel.

On arriving at the plant through a 12-inch sewer, the sewage is first screened through an inclined screen having an effective area of 12.7 square feet. The screen is constructed of ⅜-inch iron rods set ⅞-inch on centers, thus affording a clear opening of ½ inch. The frame is of oak, and the screen fits into a groove to facilitate removal.

The screen chamber is 8 feet 6½ inches long, divided into two compartments each 3 feet wide and 5 feet deep with a depth to the flow line of 3 feet. The invert of the main sewer is 6 inches above the flow line of the screen chamber. In the 9-inch dividing wall between the two compartments of the screen chamber and adjacent to the septic tank, is a 12-inch sluice gate which permits the flow of sewage to pass into one or both septic tanks as desired.

The sedimentation or septic tanks, two in number, are each 49 feet long with a total depth of 10½ feet at the inlets and 8½ feet at the outlets. The flow line depth of each tank is 7½ feet and 5½ feet at the inlets and outlets, respectively. One tank is 10 feet wide and the other 8 feet wide, and their capacities to the flow line are 22,000 and 17,600 gallons, respectively. The period of flow, with both tanks in use, based on the treatment of 70,000 gallons of sewage per day, is more than twelve hours.

The inlet to each tank is a 12-inch pipe controlled by a 12-inch sluice gate. The outlets of each tank are three in number and are rectangular openings 3 inches wide and 13 inches long, symmetrically placed with reference to the sides of the tanks and spaced 31 inches apart. Each of the three outlets is controlled by a sluice gate. The inlets and outlets of the tanks are baffled by means of wooden plants. Sewage from each tank flows over a 12-inch weir into a small chamber from which extends to the dosing tank a 12-inch pipe laid on a grade of 1.44 per cent.

To provide for the removal of the sludge, the tanks are designed 2 feet deeper at the inlet than at the outlet ends. The bottoms are sloped to the central partition wall at the inlets. At the latter point in each tank is a sludge outlet consisting of an 8-inch pipe controlled by a sluice gate which can be operated from the top of the tank.

From the septic tanks, the sewage flows into a dosing tank which is 24 feet square with a depth below the flow line of 5.1 feet. The dosing tank is located in the center of the filter area. With an allowance of 15 per cent for inflow, during the discharge of the automatic siphonic controlling apparatus, the volume of each dose will be about 22,000 gallons when the siphon is drawing from a 5.1-foot head. This dose is sufficient to cover one of the filters to a depth of 4 inches.

The filters are to be four in number, each ¼-acre in area. They are to be enclosed by earthen embankments. The filtering material is to be of sand, of three different grades, underlaid by 18 inches of gravel, making a total depth of 5 feet. The filters are suitably underdrained by 4-inch vitrified pipe leading into a main underdrain 10 inches in diameter. The bottoms of the filters are sloped toward the underdrains.

As mentioned above, the sewage is to be applied to the filters in doses controlled by alternating siphons located in the dosing tank. The sewage is to be distributed over the surface of the filters through a vitrified pipe.

The piping from the dosing tank is arranged for future extension by constructing two lines of 10-inch pipe, which extend from the dosing tank through two embankments which separate two units. This provides for the flooding of four additional units. Each siphon is provided with a sluice gate so that for future extension to additional units, the original filters may be rested. This feature entails hand operation to a certain extent when the volume of sewage shall have exceeded the capacity of the one acre of filters for present installation, but obviates the construction of a second dosing tank and the installation of additional automatic apparatus when the plant must be enlarged. The sewage is to be alternately discharged on to the units provided for future extension.

Sewage from the low level district will be raised to the sewage purification plant by means of two 3-inch centrifugal pumps belt connected to a 10-horse power electric motor. This pumping machinery is to be located in a frame structure immediately over the pump well. Full details of the machinery have not yet been decided upon.

The plans submitted April 7, 1909, by Mr. F. E. Myers, were considered by the Board at its meeting held April 22, 1909, and were approved provided:

1st. That the proposed plant be installed before any of the proposed sewers are placed in use.

2nd. That samples of all filtering material be submitted to and receive the approval of the State Board of Health before being placed.

3rd. That detailed plans of the pumping machinery and automatic controlling devices be submitted to and receive the approval of the State Board of Health before being installed.

4th. That this approval be void after May 1, 1910, unless construction of the works is commenced before that date.

REPORT ON PROPOSED SEWERAGE AND SEWAGE PURIFICATION FOR MARBLE CLIFF.

Plans and specifications for a proposed system of sanitary sewers and sewage purification works for the village of Marble Cliff, Franklin County, were submitted on April 14, 1909, by Messrs. Bradbury and Shute of Columbus, consulting engineers. The plans were referred to the engineering department and the following report was made:

Marble Cliff is a small residential village having a population of about 150, located westerly from the city of Columbus on the north bank of the Scioto River. The corporation covers an area of about 120 acres, and the built up portion is situated on the high ground overlooking the Scioto valley. At present there is no system of sewers and the sewage from the various residences is discharged into gullies and cesspools; being disposed of in an unsanitary manner besides tending to pollute the Scioto River about the Columbus water supply intake.

It is proposed to construct a system of domestic sewers of 8-inch vitrified pipe, having a total length of over 8,000 feet and providing for an ultimate tributary population of 300. The main sewer is to discharge at the proposed site for purification works which will be located on a tract of land in the southeasterly portion of the corporation some 200 feet northerly from the Dublin Pike.

The capacity of the purification works is based on a tributary population of 150 people at 100 gallons per capita, or 15,000 gallons per day. The method proposed includes screening, tank treatment, contact filters, and sand filters.

The sewage on arriving at the plant will first pass through a screen made up of parallel bars having an open space of 1 inch in the clear.

It will then pass into sedimentation tanks which are three in number, each 12 feet long, 5 feet wide, and 6 feet deep to the flow line, having a total capacity of 7,800 gallons or slightly over twelve hours flow based on the nominal capacity of the plant. The details of the tanks as regards inlets, outlets, baffles, and draining facilities, are satisfactory, and they are so connected as to permit operation either in parallel or in series. The tanks will be covered with a flat concrete roof provided with manholes.

From the sedimentation tanks the sewage will pass into a distributing chamber in which will be located suitable alternating devices for regulating the flow to the contact filters. In this chamber will be also a measuring weir.

The contact filters are three in number, of trapezoidal form, each having an area of 2,300 square feet and an average depth of approximately 5 feet. These filters are to be, essentially, watertight tanks filled with cinders or other satisfactory filtering material. The discharge from these filters will be automatically regulated. Based on the nominal capacity of the plant, the filters will be operated at the rate of 1,000 persons per acre-foot, or 300,000 gallons per acre per day. This is a conservative rate for contact filters.

The contact filter effluent is to be further treated on sand filters. There are to be three of these filters of equal size, having a total area of about 0.05 acre. The rate of filtration will be 300,000 gallons per acre per day. The sand filters are enclosed by substantial concrete walls and are suitably underdrained. The character of the filtering material has not yet been definitely decided upon.

The final effluent from the sand filters, with proper operation of the plant, will doubtless be as well purified as can be expected from any sewage plant except where disinfection processes are used. It is believed that the general design is entirely suitable for the conditions involved, and that when the plant is in operation the danger to the Columbus water supply now occasioned by the unsanitary disposal of wastes from Marble Cliff will be practically eliminated.

At a meeting held April 21st, 1909, the State Board of Health approved these plans, as shown on drawings and as described in specifications submitted April 14th, 1909, by Messrs. Bradbury and Shute, provided:

1st. That samples of all filtering material be submitted to and receive the approval of the State Board of Health before being placed.

2nd. That detailed drawings of all automatic apparatus be submitted to and receive the approval of the State Board of Health before the same is installed.

3rd. That the sewage purification works be completed before any of the proposed new sewers are placed in use; and that a competent person, satisfactory to the State Board of Health, be employed and held responsible by the village for the proper operation of the purification works.

4th. That this approval be void after May 1st, 1910, unless construction of the works is commenced before that date.

REPORT ON PROPOSED SEWERAGE FOR THE MASSILLON FOUNDRY & MACHINE CO., MASSILLON.

A communication under date of January 20, 1909, was received from The Massillon Foundry & Machine Company of Massillon, requesting permission of the State Board of Health to construct a drain for conveying sanitary sewage from the company's works into the Tuscarawas River. In response to this request, one of the assistant engineers visited Massillon on February 19, 1909, and made an inspection on the ground. The following report was submitted:

The problem of sewerage for The Massillon Foundry & Machine Company cannot be considered without some brief reference to the sewerage conditions of Massillon.

Massillon is sewered on the separate plan. All of the sanitary sewage is at present conducted through a main outfall sewer to a point near the southern corporation limits of the city, where it is discharged directly into the Tuscarawas River. At times of very low water, the quantity of sewage flowing is sufficient to cause a nuisance in the stream, but inasmuch as the locality is not built up with residences, no complaints have been made. In all likelihood, it will be necessary in the not distant future for the city of Massillon to purify its sewage. In addition to the sanitary sewage which enters the river through the city system of sewers, there are a number of private drains which discharge sanitary sewage and other wastes into it at various points along the water front. The flow from most of these drains is small and inoffensive, though the wastes from a brewery discharged into the river just below The Massillon Foundry & Machine Company's plant, give rise to objectionable odors during low stages of the stream. It is presumable also that more or less sanitary sewage finds its way into some of the storm sewers by way of surreptitiously constructed drains. The system of sanitary sewers does not reach all portions of the city, and furthermore, cannot be made to reach the low lying portions bordering the river without involving pumping.

The Massillon Foundry & Machine Company's works are in one of these low lying portions which cannot be sewered by gravity into the existing system, and further, the demand for sewerage in this locality is so slight that sewers are not likely to be built for a great many years to come.

The company employs from 40 to 55 men and is engaged in the manufacture of steam hammers, coal cars, friction hoists, drilling machines, and various other foundry and machine work. The processes of manufacture involve no liquid wastes and hence the problem of sewerage for the plant does not involve the consideration of such. For the convenience of its employees, the company proposes to install flush closets and a wash room, and it is proposed to convey the sewage therefrom through a drain of vitrified sewer pipe and discharge it into the Tuscarawas River below low water. While the point of discharge is opposite a fairly thickly built up portion of the city, it is not likely that a nuisance will be created at any time.

March 3, 1909, the Board approved this sewer, to discharge into the Tuscarawas River at a point on the north bank of the stream between North West Street and the tracks of the Pittsburg, Ft. Wayne and Chicago Railway, provided the company ceases to so dispose of its sewage as soon as it is practicable, in the opinion of the State Board of Health, to connect with the city sewerage system, or as soon as sewage purification works are built by the city of Massillon.

REPORT ON PROPOSED SEWER FOR MIDDLETOWN.

On April 23, 1909, a request was received from Mr. W. E. McElree, city engineer of Middletown, for approval of a proposed combined sewer to be laid in the northern part of that city. A representative of the engineering department visited Middletown on April 29, 1909, and made an inspection on the ground. The following report was submitted:

Middletown has a present estimated population of about 11,000. The city lies in the northeastern part of Butler County in the valley of the Great Miami River. The greater portion of the city is built on flat bottom land on the eastern side of the river. This bottom land is composed of glacial drift deposits of sand and gravel extending to a great depth.

Middletown is primarily a manufacturing center and has a great variety of industries, including about eight paper mills, two of which are under construction; tobacco warehouses; a rolling mill; machine shops; carriage factories; etc. The paper mills produce large quantities of liquid wastes which are discharged into the Miami River where during periods of low water they may be traced by the discoloration produced for a considerable distance below the city. Paper mill wastes are not highly putrescible and for this reason no nuisance is created. It must be borne in mind, however, that the stream is quite a large one and has a watershed above Middletown of approximately 3,000 square miles.

Though practically all of the built up portion of the city is connected with sewers, the sewage from the town has an almost negligible effect as regards the pollution of the stream. The existing sewers are all built on the combined plan and discharge into the river through four outlets. Three of these outlets, namely, those discharging at the foot of Second Street, at the foot of Fifth Street, and at the foot of Ninth Street, were built previous to 1893 and were therefore not brought to the consideration of the State Board of Health. The fourth outlet, namely, that opposite Grand Avenue, was investigated by a committee of the State Board of Health in 1896 and approved conditionally. The letter of approval is given as follows and shows very clearly the attitude of the Board at that time toward sewerage for Middletown.

"COLUMBUS, OHIO, December 14, 1896.

"B. HARWITZ, ESQ., *City Solicitor, Middletown, Ohio.*

DEAR SIR: The State Board of Health has considered your application to approve the outlet of a proposed trunk sewer, to discharge into the Big Miami river on a line, or nearly so, with Grand avenue. The Board wishes to discourage the discharge of raw sewage into running streams, and views with approval the plan of ultimately collecting all the sewage of Middletown at one point for the purpose of purification. Having in view the fact that the proposed sewer will carry but little household sewage for some years to come, the outlet has been and is hereby approved, subject to the proviso that the city of Middletown will agree to purify its sewage in a manner satisfactory to the State Board, whenever such purification shall be deemed necessary by the Board.

Yours truly,
(Signed) C. O. PROBST,
"By order of the Board." *Secretary.*"

Proposed Sewer. The proposed sewer is intended for the purpose of receiving the wastes from a new paper mill now in course of construction, for removing storm water from about 200 acres in the northern portion of the city, and also for removing sanitary wastes from this section when it shall have become built up.

The paper mill referred to, belongs to the Harvey-Gardner Paper Company and will have a 12-inch drain leading to the sewer. This drain will probably discharge about 1,000,000 gallons of waste water per twenty-four hours, and it is of such size and on such grade that the total quantity of wastes reaching the sewer may not exceed 2,000,000 gallons per day.

At the present time, the population living in the locality tributary to the sewer is very small and does not exceed 600 persons. Probably not over 250 persons will connect with the sewer for sanitary purposes within a year after its completion. It is expected, however, that the existence of the sewer will stimulate building in the area tributary to it, and that ultimately it will receive the sewage from a population of about 2,000.

The proposed sewer will consist of 2861 feet of concrete egg-shaped section (having a small diameter of 3 feet 6 inches and a large diameter of 5 feet), 1400 feet of 36-inch sewer pipe, and 1226 feet of 30-inch sewer pipe. The total cost of the sewer will be about $23,000. The entire concrete portion of the sewer passes through low lying ground subject to flood and not likely at any time to be used for building purposes. It is observed that the manhole covers on this section of the sewer are shown at so low an elevation that high flood waters might enter them and cause sewage to flow out of them. This difficulty may be readily overcome by simply building the manholes higher.

The outlet of the proposed sewer is shown at the head of a tail-race about 2,000 feet long. This tail-race receives at its upper end the discharge from the turbines of the water works. At a distance of about 250 feet farther down, it receives the discharge from the turbines of several paper mills. At a still lower point along its course, it receives at intervals the discharge from the turbines of three or four more paper mills.

The objectionable liquids which already enter the tail-race are the liquid manufacturing wastes from the paper mills above mentioned and also the sewage from the Second Street sewer. The quantity of clean water flowing in the race is, however, quite large and capable of preventing nuisance at all times. The sewage is very small in amount as compared with the paper mill wastes and is scarcely perceptible beyond the mouth of the sewer.

The level of the water in the tail-race usually stands at about 78 city datum and varies but slightly except during high water which rises above level 78. The elevation of average high water is about 88 and the level of extreme high water is 92.6. With the outlet of the proposed sewer at the point above noted, it is possible that during extreme high water, sewage from the proposed outlet may back up into the wheel pit of the pumping station, overflow the surrounding land, and get into one of the water works wells. Inasmuch as the well is shut off during extreme high water, the danger from such an occurrence as described would not be very great, yet the entrance of sewage into the well must be considered decidedly undesirable. This difficulty may be overcome by extending the sewer along the bank of the tail-race so as to bring the outlet a little below and opposite the discharge from the turbines of the paper mills 250 feet below the head of the race.

In connection with the investigation relative to the proposed sewer, an attempt was made to ascertain the feasibility of building an interceptor so that all of the sewage might be conveyed to a sewage purification plant, should purification at any time become necessary. Accurate data was not available, yet it is believed that an interceptor could be built provided the sewage is pumped.

Practically the whole city is already provided with sewerage on the combined plan. The proposed new sewer will receive but a comparatively small quantity of domestic sewage, but will have as its main purpose the carrying off of storm water and large quantities of manufacturing wastes. It would hardly seem reasonable, therefore, to provide the district tributary to the proposed sewer with sewers on the separate plan. It would of course have been far more satisfactory had the city started its sewerage system on the separate plan, but under present conditions it is not practicable to change the system. Should purification of the sewage ever become necessary, the construction of an intercepting sewer will no doubt be the most economical solution of the problem.

June 7th, 1909, the Board approved these plans provided:

1st. That the outlet be carried down stream to a point just below the discharge of the turbines of the Oglesbee Paper Company and the Paul A. Sorg Paper Company mills.

2nd. That the tops of all manholes be carried above the level of high water.

3rd. That an intercepting sewer be built and purification works be installed whenever in the opinion of the State Board of Health such works become necessary.

4th. That this approval be void after June 1st, 1911, unless construction of the sewer is commenced before that date.

REPORT ON PROPOSED SEWAGE PURIFICATION FOR MONROEVILLE.

On October 25, 1905, the State Board of Health approved of a system of sewers for Monroeville on the following conditions:

> "1st. That the main outlet be extended, by means of iron pipe, well out into the current and discharged below the level of the lowest stage of the river;
>
> 2nd. That the village of Monroeville obtain control of land adjacent to the river below the proposed site for the outlet for use for sewage disposal purposes;
>
> 3rd. That plans for sewage disposal plant be prepared and submitted to and approved by the State Board of Health before any of the proposed sewers are built; and,
>
> 4th. That such sewage purification plant, after having been approved by the State Board of Health, be constructed whenever the number of persons using the proposed sewers amounts to 200 or more, or at such time as may be found necessary by said Board."

The conditions of approval have been observed with the exception that plans for sewage purification works were never submitted. Several requests have been made for these plans, but these requests have not been complied with.

A recent visit to Monroeville by the engineer of the Board (October 6, 1909), indicated that only a very small portion of the sewerage system has been constructed and that it is not likely that the system will be rapidly extended. There are as yet but 25 connections, and new connections are being made very slowly. The flow of sewage is extremely small and has no appreciable effect on the appearance of the stream for a distance of more than 10 feet below the outlet.

All things considered, it does not seem likely that a sewage purification plant will be necessary for at least five years to come. It would not be advisable, therefore, to place the village at the expense of having plans made for the reason that the development in the art of sewage disposal is so rapid that plans made now would probably not prove satisfactory five or more years hence.

At a meeting of the Board held October 14th, 1909, this matter was considered and it was voted to rescind the Board's former action in approving sewers for Monroeville (October 25th, 1905) in so far as this related to the submitting of plans for sewage purification works at that time (October 14th, 1909).

REPORT ON PROPOSED SEWERAGE AND SEWAGE PURIFICATION FOR MT. GILEAD.

On February 24, 1909, a communication was received from Mr. W. B. Eells, village engineer of Mt. Gilead, requesting approval for a proposed system of sewers and sewage purification works for that village. This communication was followed by a conference on March 10, 1909, between one of the engineers of the State Board of Health and the village engineer, and on March 29th one of the engineers visited Mt. Gilead for the purpose of making an examination on the ground. On April 6, 1909, revised general plans for the purification works were submitted for action of the Board. These plans were referred to the engineering department and the following report was made:

The village of Mt. Gilead lies in the central part of Morrow County of which it is the county seat. Whetstone Creek, a tributary of the Olentangy River, passes through the southern portion of the corporation and flows away in a general southwesterly direction. The population of Mt. Gilead as based on United States census reports and local estimates, is in the vicinity of 1,700, and apparently the population is increasing very slowly. The area of the village within the corporation limits is 597 acres, or about 0.9 square mile. The territory within the village limits as well as the surrounding country is moderately hilly, and the conformation of the surface within the corporation is such as to make the location of sewers having proper gradients a comparatively simple matter. Mt. Gilead is primarily a farming center and is also a rather important cattle and horse market.

Proper sewerage for the village is entirely lacking. There have been built from time to time storm water drains, to which connections have been made for sanitary purposes from a large number of dwellings. These drains are generally crudely constructed and discharge at the most convenient outlet. As the volume of sanitary sewage increased, these outlets became a source of annoyance to nearby residents, due to the foul odors that arise therefrom.

The problem of sewerage for Mt. Gilead was first considered by the State Board of Health in 1902 when plans were submitted for a system of sanitary sewers with sewage purification works, the method of purification being settling tanks and sand filters. These plans were approved by the Board in 1903 but were never carried out.

In 1908 one of the assistant engineers of the Board made an inspection of sanitary conditions at Mt. Gilead. The report submitted showed that the existing sewers were improperly constructed and incapable of serving the needs of the village; that the discharge from the main sewer caused objectionable pollution in Whetstone Creek; and that an adequate system of sanitary sewers for the village should be installed. A copy of the report was sent to the local officials.

Proposed Plans. It is now proposed to install a sewerage system which in its essential features is like the one approved by the State Board of Health in 1903. For immediate installation, there will be constructed about 1½ miles of sewers which will reach 300 or 400 persons, while in the course of a few years it is expected that 1,500 people will be accommodated.

The sewage purification works as shown on plans submitted are designed to treat 60,000 gallons, or the sewage of 775 people. For present installation, however, but ¼ acre of filters, or a plant having a nominal capacity of 20,000 gallons will be installed. The method proposed is settling tanks and intermittent sand filters. The plant is to be located on a 4-acre tract of land in the southern part of the corporation bordering Whetstone Creek, into which the purified sewage will discharge. The site is not so well located as regards proximity to habitations as could be desired. There is one house within 150 feet which will be occupied by the caretaker, and three more within 300 feet. On account of the small size of the plant, however, it is not probable that objectionable conditions will be created.

The sewage after passing through a screen having a ½-inch open space and located in a suitable screen chamber, will discharge into the sedimentation tanks. These tanks are two in number, each 24 feet by 8 feet by 7 feet deep below the flow line, thus giving a total capacity of 20,000 gallons or eight hours flow based on the nominal capacity of 60,000 gallons. The inlets and outlets are constructed in accordance with approved practice and the tank is well baffled. Adequate means for draining are also provided.

The effluent from the sedimentation tanks will pass into a dosing chamber 17 feet by 26 feet by 3 feet deep, having a capacity of 10,000 gallons and containing three alternating automatic siphons. Each dose will flood one filter to a depth of 1½ inches. The dosing chamber as well as the tanks are to be covered by a frame building.

The sand filters are three in number, each 60 feet by 180 feet at the surface, representing a total area of ¾ acre. The filtering material, composed of sand and gravel, will have a total thickness of 3 feet. Samples of the filtering material are to be approved by the State Board of Health later. The filter beds are suitably underdrained and the system for distributing the sewage over the surface of the sand is satisfactory.

For the disposal of the sludge, there has been provided a sand filter 86 feet by 30 feet, which is of sufficient area to receive the contents of one tank without undue flooding.

At a meeting held April 22nd, 1909, the State Board of Health approved the plans, as shown on drawings submitted April 6th, 1909, by Mr. W. B. Eells, village engineer, provided:

1st. That samples of all filtering material be submitted to and receive the approval of the State Board of Health before being placed;

2nd. That one-fourth acre of filtering area be constructed before any of the new sewers are placed in use, and that the entire works as shown on the plans be completed within one year after the first installation is placed in use; and,

3rd. That this approval be void after May 1st, 1910, unless construction of the works is commenced before that date.

REPORT ON PROPOSED ADDITIONAL SEWERAGE FOR NILES.

At a meeting of the State Board of Health held January 20th, 1909, Mr. John S. Naylor, mayor of Niles, and Mr. F. M. Brewer, city engineer, presented plans for proposed sewerage for the Fourth Ward of that city. The plans were referred to a committee consisting of Dr. Warner and the chief engineer. The following report was made:

The Mahoning River at Niles, which has been used to a greater or less extent as a water supply, is badly polluted by the sewage of Warren, and the indications are that this water has caused considerable sickness in Niles. The Niles officials, therefore, blame the city of Warren for polluting this water supply. On the other hand, however, the same officials have asked the State Board of Health to permit them to discharge from Niles more sewage into the Mahoning River within ten or twelve miles of the Youngstown water supply. The latter supply is filtered, but at the same time it would seem that the people of Youngstown were entitled to consideration on the part of the communities above them.

Proposed Additional Sewerage. It is desired to construct about 1,500 feet of 12 and 15-inch sewer in South Main Street in the Fourth Ward, and to discharge the same into the Mahoning River under the Main Street bridge. Tributary to the proposed sewer in Main Street will be a few hundred feet of 8 and 12-inch laterals in First, Second, Third and Brown streets.

The present population tributary to the proposed sewer district is about 1,100, although it is estimated that not more than 100 or 200 will connect with the sewers at the present time.

Aside from causing pollution of the Mahoning River, the introduction of sewerage in the Fourth Ward would be desirable for the reason that at present the people are using unsanitary privy vaults and, furthermore, the cellars are said to be damp and badly in need of drainage.

The Board considered these plans, submitted by the mayor and city engineer on January 20th, 1909, at its meeting on April 22nd, 1909, and the same were disapproved.

The authorities of Niles were urged to carry out the plans for an intercepting sewer and sewage purification plant, already approved by the State Board of Health.

REPORT ON PROPOSED SEWAGE PURIFICATION FOR OBERLIN.

On April 13, 1909, there were submitted by Mr. W. F. Schickler, village engineer of Oberlin, plans for proposed sewage purification plant for that village. In anticipation of these plans being submitted, an inspection of the site was made by a member of the engineering department on March 18, 1909. The plans were referred to the engineering department for examination and the following report was submitted:

The village of Oberlin, the site of Oberlin College, has a population of 5,200 during the school year and a summer population of 4,300. The village is located on Plum Creek, a small tributary of Black River. There is a fairly complete sewerage system, built on the separate plan, well underdrained, and comprising 11.7 miles of sewers. The construction of this system was commenced in 1892.

At the time of the construction of the first sewers, there was installed a sewage purification plant built on the broad irrigation plan. This plant has been fully described in past printed reports of the Board. The plant filled the needs of the village for some years but gradually became overloaded, so that since 1904 chemicals have been applied to the sewage during part of the year and the filter beds transferred into settling tanks. This chemical treatment improved the condition of the effluent to a certain extent, but the increasing amount of sewage made necessary a new plant in a new location. Accordingly, in 1907, the 18-inch main sewer was extended some 2,500 feet to a 80-acre tract of land on the opposite side of the creek from the original plant and farther down stream. This site was approved by the Board in 1906, but at the same time the method then in use for purifying the sewage was disapproved.

In April, 1907, the Board again disapproved the plan of purifying the sewage by chemical treatment and broad irrigation. The village took no further steps at that time toward establishing a suitable purification plant.

Owing to numerous complaints of the pollution of the stream during the season of 1908 and previous thereto, and also on account of damage suits brought against the village, the local officials have been incited to take definite steps toward establishing new purification works, with the result that plans for such works are now submitted to the Board by the village engineer.

Proposed Plans. The proposed plant as shown on plans is designed to purify not more than 250,000 gallons of sewage per day. Measurements of flow indicate a flow of from 125,000 to 170,000 gallons per day at the present time. The method proposed is screening, sedimentation, treatment on contact filters, and final treatment on sand filters.

The sewage on arriving at the plant through the 18-inch trunk sewer, is first to be screened through a screen constructed of parallel iron bars having an open space of ½ inch and located in a suitable screen chamber which, incidentally, contains a relief overflow.

The settling tanks have already been constructed. These are two in number, each 30 feet by 37 feet in plan with an average depth of 6 feet 2 inches. The combined capacity of the tanks is 116,000 gallons, representing a period of flow of about eleven hours based on the nominal capacity of the plant. The settling tanks while not designed in accordance with the best practice, will probably serve the purpose sufficiently well, and their abandonment would not be justified. Furthermore, it is intended to improve their efficiency by placing therein wooden baffles. A drain at the bottom of the tanks discharges on to a suitable sludge disposal area.

The effluent from the settling tanks is to be first treated in six contact filters, each about 30 feet by 74 feet in plan and having a total area of 0.33 acre. The walls of these filters are to be of concrete and the filtering material, 5 feet in depth, will probably be broken limestone. The flow of sewage on to and from the contact filters will be controlled by automatic devices to be located in chambers shown on plans. The details of such devices, however, have not yet been decided upon.

The effluent from the contact filters after passing into distribution manholes, is to be distributed to the sand filters. These filters are four in number and have a total area of about 0.45 acre. The filtering material is to be lake sand. The filters are satisfactorily underdrained by 6-inch lateral drains leading finally into a 10-inch pipe which discharges through an outlet manhole into Plum Creek. In this manhole is to be located a balanced valve so that in case of high water in the creek, the filters will not be damaged.

By means of the distribution manholes above mentioned, the flow from any of the contact filters can be discharged on to any of the sand filters. The discharge pipes for the contact filters, therefore, in a way serve as dosing apparatus for the sand filters.

The plant as shown on plans will without doubt prove satisfactory if properly operated. The rates of treatment are conservative and the degree of purification will be sufficient to fulfill the local requirements. If at times it should be necessary to by-pass a portion of the sewage on account of storm water reaching the sewers from leaky joints, it is probable that at such times Plum Creek will have an abnormally large flow and that a nuisance will, therefore, not be created.

At a meeting of the Board held April 22, 1909, these plans submitted April 13, 1909, by Mr. W. F. Schickler, were approved provided:

1st. That samples of all filtering material be submitted to and receive the approval of the State Board of Health before being placed.

2nd. That details of all automatic apparatus be submitted to and receive the approval of the State Board of Health before same is installed.

3rd. That this approval be void after May 1, 1910, unless construction of the plant is commenced before that date.

REPORT ON PROPOSED SEWERAGE AND SEWAGE PURIFICATION FOR VERMILION.

On April 17, 1909, Messrs. Nichols and Meuhlberg of Lorain, consulting engineers, submitted plans for sewerage and sewage purification for the village of Vermilion. These plans were reviewed by the engineering department and a conference was held on May 11, 1909, between one of the assistant engineers of the State Board of Health and the consulting engineers. Revised plans embodying a number of changes were submitted May 29, 1909. The following report is based on these revised plans:

Vermilion is a village lying on the shore of Lake Erie at the mouth of the Vermilion River. Its population as indicated by census reports, is in the vicinity of 1200. During the summer the population is considerably increased by summer visitors, reaching perhaps a maximum of 2000. The village is provided with water supply and other public improvements, but has been without an adequate system of sewers. It is now proposed to install a system of sewers on the separate plan covering the main portion of the village, and to purify the sewage before discharging same into the Vermilion River.

The system of sanitary sewers has a total length of about 5.3 miles and comprises the following:

8-inch pipe,	18,098 feet.
10-inch pipe,	6,792 feet.
12-inch pipe,	1,643 feet.
18-inch pipe,	1,383 feet.

It is estimated that the sewers will be capable of caring for an ultimate flow of 900.000 gallons per twenty-four hours, and the area that may be drained is 225 acres. Within a year following construction of the system, it is anticipated that about 500 to 600 persons will be made tributary thereto. Based on this assumption combined with a consideration of data relating to water consumption, the purification works have been designed for a nominal capacity of 90,000 gallons per twenty-four hours.

PURIFICATION WORKS.

Purification will be effected by the following means: The sewage will be received by gravity into several sedimentation tanks after a preliminary screening. From the sedimentation tanks the sewage will be raised by means of air displacement pumps to a dosing chamber equipped with automatic apparatus for distributing the dose to various filter units. From the dosing chamber the sewage will flow to intermittent slow sand filters of which the present installation will include four. The effluent from the intermittent sand filters will be permitted to discharge into the Vermilion River. Provision is made for discharging crude and settled sewage into the river direct.

Site. The site selected for the location of the purification works is a 7½-acre tract of land located immediately south of the Nickel Plate Railroad bridge over the Vermilion River. The land is sufficiently removed from any habitation to preclude likelihood of objectionable nuisance. In order to convey all of the sewage from the village to a single point, it is necessary to place the outfall sewer at a relatively low elevation; hence, the necessity of pumping the sewage from the sedimentation tanks into the dosing chamber. The following figures will show the relative elevation of the various parts of the works:

Mean water level in Vermilion River	—2.0 feet.
Average high water	0.0 feet.
Maximum high water	1.9 feet.
Surface ground at site of purification works	3.0 feet.
Invert of sewer at entrance to works	1.1 feet.
Water level in sedimentation tanks	1.1 feet.
Water level in dosing chamber	14.5 feet.
Surface of sand filters	10.0 feet.
Main underdrain at outlet of filters	5.0 feet.

Screens. Screens will be placed in the inlet channels to the sedimentation basins on either side of the outlet of the main sewer. These screens are to be made up of horizontal bars held in a frame which is supported in a vertical position by grooves. The screens will be very inaccessible and difficult to clean. The arrangement is not satisfactory and should not be approved.

Settling Tanks. There will be two settling tanks of reinforced concrete, each 39 feet long, 10 feet wide, and 7 feet deep to the flow line, thus giving a capacity of 20,500 gallons. This represents a period of flow of 10.6 hours with one tank in use and based on a daily flow of sewage of 90,000 gallons. The sewage will be admitted from the entrance channel into the tanks by means of adjustable weirs, one for each tank. The sewage from the tanks will be drawn off in like manner into an outlet channel similar to the entrance channel. The sewage will be distributed across the width of the tank by means of submerged baffles placed about 24 inches from the inlet and outlet ends of the tanks. The bottom of the tank will be slightly graded toward the center for the purpose of collecting sludge. When it becomes necessary to remove sludge, some form of temporary pumping equipment must be used. Sewage from the sedimentation tanks passes to the pumps which will be in duplicate and of the air displacement type manufactured by Latta and Martin. Each pump will have a capacity of 150,000 gallons per twenty-four hours. They will be operated by compressed air furnished from the water works pumping station several thousand feet distant.

Dosing Tank. The dosing tank will be 26 feet square and 3 feet deep to the flow line, thus giving it a capacity of 15,200 gallons or about four hours flow of sewage. The dosing tank will be equipped with four automatic alternating siphons of the type manufactured by the Pacific Flush Tank Company. Space is left for the installation of four additional siphons when same become necessary.

Sand Filters. The four sand filters will each be 94½ feet long by 86½ feet wide, representing an area of 3/16-acre or a total area of 0.75 acre. The filtering material will consist of 2½ feet of lake sand supported upon 6 inches of graded gravel. Underlying the graded gravel will be placed lines of 4-inch drain tile longitudinally of the bed, which lines will be 14 feet center to center. A main 10-inch drain tile will extend transversely across the beds, and as the filters are to be placed in a row, the single main drain will serve all four of them. The sewage will be distributed on to the filters by means of wooden distributing troughs discharging at five points on the surface of the sand. One dose from the dosing chamber will cover a filter to a depth of 3.4 inches.

A sludge filter will also be provided which will be 40 feet square. It will be filled with filtering material to a depth of 4 feet, the same to be composed of lake sand and gravel. Underdrainage will be furnished by a single 10-inch tile in the bottom.

At a meeting held June 17th, 1909, the State Board of Health approved these plans for sewerage and sewage purification for Vermilion, as submitted May 29th, 1909, by Messrs. Nichols and Meuhlberg of Lorain, consulting engineers, upon the conditions:

1st. That the screens be provided with vertically placed instead of horizontally placed bars, and be made readily accessible for cleaning and repair by dispensing with the concrete covering over them;

2nd. That careful records be maintained of the number and location of all house connections; and,

3rd. That this action of the Board be void after July 1st, 1910.

REPORT ON PROPOSED SEWERAGE AND SEWAGE PURIFICATION FOR WARREN.

On September 28, 1909, there were received from Mr. Alexander Potter of New York City, consulting engineer for Warren, a set of plans and a descriptive report relative to proposed new sewers, changes in existing sewers, and sewage purification works for that city. The following report by the engineering department was submitted:

The city of Warren lies in the south-central part of Trumbull County, of which it is the county seat. The present population is variously estimated at from 9,000 to 12,000. The census reports would indicate (assuming that the growth of the city has been constant) a population of nearly 11,000. Owing, however, to the fact that a number of important industries at Warren have been removed during the past decade, it is probable that the growth of the city has received more or less of a setback, and all things considered, it would appear that an estimate for the present population of between 9,000 and 10,000 is about correct. Warren is an old city and there are no indications that its growth will be very rapid in the future, and it is safe to assume that the population in 1920 will not exceed 15,000.

Warren lies on the Mahoning River at a point 36 miles below Alliance, the only city above Warren which contributes a considerable amount of pollution to the river, and 17.3 miles above Youngstown, the first city below which derives its public water supply from the river. Between Warren and Youngstown are the communities of Niles and Girard, located, respectively, 7 and 13 miles below Warren. As indicated by extensive investigations of the Mahoning River made by the engineering department of the State Board of Health, the Mahoning River above Warren shows but slightly the effect of contamination. The influence of the large quantity of sewage discharged into the stream at Alliance cannot be detected even by analytical methods at a distance greater than 11 miles below that city, and the additional pollution which enters the stream nearer Warren is practically negligible. Below Warren conditions are very much changed owing to the discharge in the river of the entire sewage flow of Warren itself. Along the river front within the limits of the corporation are 13 sewer outlets, which carry the sewage of an estimated population of 7200. The total length of existing sewers is about 27 miles, of which the greater portion is built upon the combined plan. Eight of the outlets above referred to are for combined sewers and five are for sanitary sewers. Notwithstanding the large amount of sewage entering the stream from the city, the river below, even during stages of low water, is not so grossly contaminated as to become a public nuisance. There are not lacking, however, visual evidences of contamination, such as excessive growths of weeds, algae, and other plant life that thrives on organic matter contained in the water. Below Warren considerable self-purification of the stream takes place, and it is quite likely that the quality of the water in the river at Youngstown is not greatly influenced by the sewage discharged into the stream at Warren. It happens, however, that from Niles and Girard and also Youngstown itself above the water works intake, there is introduced a considerable quantity of sewage and other polluting matter which more intimately affects the water supply of Youngstown and obscures the effect which pollution from Warren might have.

The effect of the sewage from Warren on the Mahoning River may be examined from a somewhat different point of view; namely, on the basis of the flow of water in the river as compared with the population tributary to the sewers. The lowest dry weather flow in the Mahoning River observed in the exceedingly dry summer and autumn of 1908, shows 45,000,000 gallons per day. This based on the present population connected with the sewers gives a flow of 9.8 cubic feet per second per 1000 persons connected. This is more than double enough to take care of the sewage flow without nuisance, and then again during most seasons the flow in the stream is many times the figure above given. Based on the above estimates of population, it is not likely that even with a very complete system of sewers, there will be a population tributary within ten years greater than 12,000. Based on this population, the available dilution of sewage flow would be 5.9 cubic feet per second per 1000 persons tributary.

Notwithstanding the fact that the flow of sewage from Warren is not great enough to cause a public nuisance in the stream below the city, yet owing to the accumulations of foul deposits near sewer outlets during times of low water, there is occasioned considerable local nuisance. The local nuisances could of course be avoided by the construction of an intercepting sewer which would convey all the sewage below the city to an outlet so constructed as to discharge the sewage into the channel of the stream. This solution of the problem would not be altogether satisfactory, however, for the fact that the river is used as a source of public water supply at Youngstown must not be lost sight of, and a greater degree of contamination than now existing in the river would not be permissible during dry weather.

Before discussing the proposed sewers and sewage purification which the city now desires to bring before the Board for consideration, it will be well to review briefly former actions of the Board in connection with the sewerage of Warren.

PREVIOUS ACTIONS OF THE STATE BOARD OF HEALTH IN CONNECTION WITH SEWERAGE OF WARREN.

The first action taken by the State Board of Health in connection with sewerage was on October 31, 1895, when the Board voted to approve plans for certain proposed additional sewers provided "sewage purification works, satisfactory to the Board, shall be built within two years from date of the first use of the new sewers, and provided further, that all sewage from Warren shall be by that time satisfactorily purified before discharging it into the Mahoning River."

On October 14, 1903, the State Board of Health permitted the outlet of the existing sewers to be changed from a point above to a point below the water works intake. This permission was given without condition.

Early in 1906, the city of Warren requested the approval of the State Board of Health of the construction of an independent system of sanitary sewers in the northwestern part of the city on the west bank of the Mahoning River with an outlet directly into the Mahoning River. This system was to receive the sewage from 100 houses and it was not anticipated that this number would be more than doubled at any time in the future. In February, 1906, the Board approved of the construction of this sewer system provided same would be connected with an intercepting sewer for the entire city as soon as such sewer was built. Also the authorities were notified that in accordance with the approval of proposed additional sewerage in 1895, a condition was imposed whereby the city was to install means for purifying the sewage from the entire city within two years from the date the sewers were placed in use, and that it was the intention of the State Board of Health to make a thorough examination into the discharge of sewage at Warren as soon as dry weather conditions prevailed, the results of which examination would probably show such objectionable conditions that the Board would find it necessary to require purification works for the city to be built at once; for which reason the city authorities might desire to postpone the construction of the proposed sewer until permanent arrangements for the disposal of the remainder of the city sewage were made.

In accordance with informal recommendations made during the summer of 1908 following an examination of the Mahoning River, the city began actively to undertake the design of an intercepting sewer and sewage purification works. At the request of the local authorities, the State Board of Health at its meeting on April 22, 1909, considered the advisability of the use of combined sewers and decided in the light of information before it that combined sewers with storm water overflows directly into the river were not permissible. At a later period the Board at the request of the local authorities reconsidered this action in the light of additional information and voted (August 4th, 1909) to approve the combined system of sewers where necessary, provided:

"1st. That the quantity of storm water to be intercepted meet the approval of the State Board of Health.

2nd. That the design of the purification works be satisfactory to the State Board of Health."

Following this action of the Board, the consulting engineer for the city proceeded with the preparation of plans for the revision of existing sewers, the introduction of additional sewers, and purification works. These plans were reviewed by the engineering department and form the basis of the following discussion.

PLANS FOR CHANGING EXISTING SEWERS AND PROPOSED NEW SEWERS.

The existing sewers at Warren comprise a total length of about 137,640 feet, divided as follows:

Size of Sewer.	*Length in Feet.*
33-inch.	1,430
30-inch.	2,770
27-inch.	2,320
24-inch.	4,420
20-inch.	5,640

Size of Sewer.	*Length in Feet.*
18-inch.	3,670
15-inch.	25,530
12-inch.	43,975
10-inch.	1,400
9-inch.	26,945
8-inch.	4,390
6-inch.	1,700
unknown.	13,450

The most of these sewers are used on the combined plan. In accordance with the conditions of approval of the State Board of Health, it is proposed to convert as many of these as possible into strictly storm water sewers and construct for the purpose of carrying domestic wastes a separate system of sanitary sewers. The city lends itself readily to the proposed extension of existing sanitary sewers, and there is no part of the city that cannot be reached by sewers laid on good grades. It is also proposed to construct an intercepting sewer which will collect the entire sewage flow and convey it to a point south of the city where an option has been secured on a suitable site for purification works. The following tables present a list of proposed additional combined and sanitary sewers, grouped according to the districts into which they are to be laid, together with an estimate of cost.

LENGTHS AND SIZES OF INTERCEPTING SEWERS.

From disposal plant to Red Run sewer	280 ft.	42-inch.
Siphon under river near Red Run	400 ft.	18-inch.
From siphon at Red Run to near Main and First streets	780 ft.	20-inch.
From Red Run sewer (A) to North Main Street	1,550 ft.	24-inch.
From North Main street to river crossing at Oak alley	1,100 ft.	20-inch.
Siphon under river at Oak alley	270 ft.	16-inch.
From Oak alley to river crossing at Buckeye street	1,860 ft.	18-inch.
Siphon under river at Buckeye street	310 ft.	16-inch.
From siphon at Buckeye street to junction of West Branch (L H)	1,480 ft.	18-inch.
East side interceptor from (L H) to East Summit street	1,550 ft.	12-inch.
Siphon under river at (L H)	230 ft.	14-inch.
Interceptor for Northwest District from siphon to point across Erie Railroad	1,810 ft.	15-inch.
Extension to Todd avenue	540 ft.	12-inch.
North Main street interceptor to Market alley	1,200 ft.	18-inch.

ESTIMATED COST OF INTERCEPTING SEWERS.

280 feet of 42-inch sewer, @ $7.00	$1,960 00
1,550 feet of 24-inch sewer, @ $3.50	5,425 00
1,880 feet of 20-inch sewer, @ $3.00	5,640 00
3,340 feet of 18-inch sewer, @ $3.00	10,020 00
1,200 feet of 18-inch (Main St.), @ $6.00	7,200 00
1,810 feet of 15-inch sewer, @ $2.00	3.620 00

2,090 feet of 12-inch sewer, @ $1.75	3,657 50
4 siphons, @ $3,000.00	12,000 00
	$49,522 50

LENGTHS AND SIZES OF EXTENDED SANITARY SEWERS.

District.	Length in Feet.		
	8-inch.	10-inch.	12-inch.
Northwest District	19,910	2,350	1,350
Southwest District	16,050	5,350	1,150
Center Street	3,250	....	....
South of Erie and east of River	1,650	1,400	....
Southeast District	1,000	3,700	....
Northeast District	12,000	4,650	....
	53,860	17,450	2,500

Estimated Cost of Extended Sanitary Sewers.

2,500 feet of 12-inch sewer, @ $1.00	$2,500 00
17,450 feet of 10-inch sewer, @ $0.90	15,705 00
53,860 feet of 8-inch sewer, @ $0.80	43,088 00
	$61,293 00

There are 146.2 acres in the central portion of the city that cannot be resewered on the separate plan except at prohibitive expense and in the face of insurmountable practical difficulties. It is, therefore, proposed to permit this area to remain on the combined plan, but provision will be made to convey to the purification works a flow from these sewers equal to four times the dry weather flow. According to figures furnished by the city engineer, there are within this area 300 house connections which may be taken as representing a population tributary of about 2,000. Based on water works pumping records, it is probable that the sewage flow per capita will equal 100 gallons per twenty-four hours, thus making the total dry weather flow from the combined sewers equal to about 200,000 gallons. If four times the dry weather flow is intercepted, it will mean that provision may be made for carrying storm water sewage to the purification plant at a rate not exceeding 600,000 gallons per twenty-four hours, which is equivalent to 25,000 gallons per hour.

Available rainfall and run-off records give no reliable basis for computing the minimum dilution the overflow would receive during dry weather conditions, but it is safe to say that before a storm has continued long enough to bring the storm overflows into operation the stream will be sufficiently swollen to take the overflow without perceptibly increasing the contamination of the stream over that which would obtain with the direct discharge of storm water alone. This opinion is based on the fact that the first and most objectionable flow of storm water is diverted to the purification works, and also on the fact that the domestic sewage which does reach the stream is diluted at least one to four. Further, the population that will remain tributary to the combined sewers is so small that even during driest seasons the stream could receive the discharge from the combined sewers without any visible effect on the stream, and it is not likely any effect, that can be detected by analytical means, would be observed as far down stream as Youngstown.

The project for sewerage improvement includes the construction of a large number of storm sewers in various parts of the city. These sewers will discharge into any convenient watercourse and most of them will have their outlets in Red Run. The storm sewers involve no peculiarities of construction. They will for the most part be built of vitrified pipe with cemented joints and will have manholes placed at convenient intervals. The following table gives the lengths and sizes of the several new storm sewers.

Size.	A	B	C	D	E	F	G	Total
48-in.				200				200
42-in.				250				250
36-in.							310	310
33-in.						1,000		1,000
30-in.	2,590	570	720	760			700	5,340
24-in.	470	810	420				500	2,200
22-in.		1,100	480				1,090	2,670
20-in.	390			810	700	500		2,400
18-in.					650	1,190	1,000	2,840
15-in.	270		330	860				1,460

NOTE :—

A — System outletting along the railroad running up through High and Vine streets.

B — Belmont and Paige streets.

C — Scott street and Elm street.

D — Elm and Washington streets.

E — Dana avenue.

F — Forest avenue and Paige street.

G — Atlantic avenue.

PURIFICATION WORKS.

Quantity and Character of Sewage. In designing the sewage purification works, it is not believed that provision for immediate installation need to take into consideration more than ten years future growth.

As already noted, it is not likely that the population of Warren in 1920 will exceed 15,000, nor is it likely that at that time there will be a population tributary greater than 12,000. A fair estimate of dry weather flow for Warren as based on water works records, is 100 gallons per capita per day or a total dry weather flow of 1,200,000 gallons. Adding to this the quantity of storm water which it is expected to intercept, namely, 600,000 gallons, and also a reasonable amount of leakage of storm water from various sources into the sanitary sewers, there would be a flow reaching the purification works during periods of storm of about 2,000,000 gallons.

Screens and Pumping Station. It was not found possible to construct the intercepting sewer so that it might reach the purification works by gravity; consequently, pumping of the sewage is necessary. It is proposed to build a pumping station with two centrifugal pumps driven either by electricity or steam, whichever may prove the more economical. The pumps will have capacities, respectively, of 3,000,000 and 6,000,000 gallons per twenty-four hours. The elevation through which the sewage must be raised is from -2 to $+25$ feet, or a total of 27 feet. Before entering the pump well, which has a capacity of approximately 60,000 gallons, the sewage will pass through a screen made of vertically placed bars having openings of $1\frac{3}{8}$ inches. It is believed that the screening arrangement can be improved by using two screens having different clear openings. The clear openings of the secondary screen should not be greater than $\frac{3}{4}$ inch, preferably $\frac{1}{2}$ inch.

Sedimentation Tanks. Sewage from the pumping station will be conveyed to the sedimentation tanks through a suitable force main. There are shown two tanks, each 122 feet long, 34 feet wide, and 10 feet deep to the flow line. The combined capacity of these tanks is therefore 624,000 gallons, representing a period of flow of 12.5 hours during dry weather and $7\frac{1}{2}$ hours during storms. Across the upper ends of the tanks is shown an inlet channel 2 feet 6 inches wide and 3 feet 10 inches deep below the flow line. From this channel, sewage will be admitted into each tank through three 12-inch square sluice gates placed on a level with the bottom of the inlet channel. These gates may be operated from a conveniently placed platform above. Two feet 6 inches in front of the inlet wall of each tank is to be built a thin partition or baffle wall provided with 33 openings each 4 inches by 8 inches in dimensions. The uppermost of these openings will be about one foot below the water level in the tank, and the lowermost will be about 6 feet below the water level. Ten feet from the outlet end of each tank is shown a submerged baffle 6 feet in height, intended to intercept sludge. Within each tank and extending across the outlet end is an outlet channel 2 feet 6 inches wide and 3 feet 10 inches deep to the flow line. The top of the inside wall of this channel is shown perfectly level and will determine the elevation of the water in the tank by acting as a weir. Three feet in front of the inner wall or weir of the outlet channel is shown a hanging baffle which reaches about 18 inches below the surface of the sewage in the tank and is intended for the purpose of holding back scum. The inlet channel has a connection with the tanks through one 12-inch sluice gate placed flush with the bottom of the channel, thus permitting the tanks to be drawn down 3 feet 10 inches at this point. From the effluent channel, sewage is conducted to the sprinkling filters through an 18-inch cast iron pipe. The bottoms of the basins have a slope from upper to lower end of 6 inches. The slope from the sides to the center is 10 inches. Along the center of the bottom of each tank is a trough 20 inches wide and with semicircular bottom. This trough has a fall of about 14 inches from end to end of tank. It is apparent that the tanks are well arranged to permit of drainage. The outlet of each tank is controlled by a 12-inch gate valve placed in a 12-inch pipe line leading to the sludge beds. The main body of the tank is shut off from that portion beyond the submerged baffle by means of a flap gate which must be opened before the sewage can be drawn down to a level below the top of this baffle.

Sprinkling Filters. The 18-inch cast iron pipe which conveys the sewage to the sedimentation tanks is enlarged into a 30-inch concrete conduit leading to a so-called dosing tank shown on the plans as a circular concrete structure 15 feet in diameter and about 10 feet deep. The elevation of the crest of the weirs in the sedimentation tanks is at 25.5, and the elevation of the surface of the sprinkling filters is at 16.5. There is thus available a total head on the filters for operating the sprinkler nozzles of 9 feet. Under ordinary circumstances this entire head will probably not be used. It is presumed that the dosing tank will be so designed as to automatically vary the head on the sprinkling nozzles.

From the dosing tank the sewage will flow to the filters through an 18-inch cast iron pipe. The present installation includes two filters, each 148 feet wide by 152 feet long. The filters adjoin each other on their long dimensions. The total area of the filters is practically one acre. Thus there will be a population tributary based on the nominal capacity of the plant of 12,000 per acre. The beds are 6½ feet deep, and thus there would be a population tributary of 1,850 per acre foot. These estimates are very conservative but must necessarily be low on account of the storm water which must at times be cared for. Expressed in quantity of sewage, the rate of filtration will during dry weather equal 1,200,000 gallons per acre per day, and during wet weather will equal 2,000,000 gallons per acre per day. The distributing pipe for conducting the sewage to the various nozzles consists of a main 18-inch cast iron distributor extending longitudinally through the entire area covered by both beds with tributary laterals leading off from the main collector in both directions at intervals of 13 feet. Along the laterals at intervals of 15 feet are placed uprights extending to the surface of the beds for the purpose of supporting the sprinkler nozzles. The laterals consist of 6-inch cast iron universal jointed pipe, and the uprights consist of 4-inch special castings. The entire system of distributing pipes is shown at about 2 feet above the floor of the filters. The filtering material has a depth of 6½ feet to the tops of the underdrains and will be composed of broken stone, the size of which has not yet been determined upon. Each filter is divided by a concrete floor 6 inches in thickness and is surrounded by a substantial concrete wall. Directly under the main distributing pipe and depressed below the floor of the filters is shown a 24-inch effluent drain made with semicircular cross-section. On either side and at right angles to the main collecting drain are shown the underdrains. These consist of 6-inch half tile pipe laid with open joints and with lines placed as closely together as possible. The upper end of the lines of tile extend through the outer walls of the filters, thus permitting of accessibility for flushing.

Without great expense, provision could be made for the disinfection of the filter effluent which may prove a desirable adjunct during periods of epidemic.

Sedimentation Basins. From the sprinkling filters the effluent will be conveyed through suitable concrete channels to sedimentation basins. These basins are divided into two units, each 3 feet deep and 49 feet by 69 feet in plan measured at the toes of the side slopes. These side slopes are shown 3 to 1. The capacity of each basin is 177,000 gallons, or a total capacity for the two units of 340,000 gallons. Based on dry weather flow, this represents a sedimentation period of 6.8 hours, and on storm flow a period of 4.1 hours. The effluent from the filters is received in a distributing channel extending across the inlet ends of the basins. The flow into the basins takes place over a flat crested weir having a length practically equal to the width of the basin. The effluent from the basins is collected in an outlet channel similar to the inlet channel. The water is also drawn off over a weir similar in structure to that at the opposite end of the units. The elevation at the outlet of the basins is at 8.0, while the level of low water in the river is at elevation —1.0. Under ordinary circumstances there is an ample fall from the sedimentation basins to the river, but at times of extreme high water these basins will be flooded and it will be necessary to discharge the sprinkler effluent directly into the stream. The plans show no means for drawing off the water from the bottom of the sedimentation basins.

Sludge Beds. The sludge beds intended to receive the sludge from the sedimentation tanks, consist of four shallow rectangular excavations in a natural wet gravelly soil found at the site of the purification works. Each of these excavations is 55 feet by 75 feet measured at the toes of the slope. The slopes are made 3 to 1. The total bottom area of the sludge beds is 16,500 feet. The sludge is admitted to these beds through two pipes controlled by valves extending out into each tank. If the entire contents of one of the sedimentation tanks were discharged on to the sludge beds, the area would be covered to a depth of about 2.5 feet. By drawing off 3½ feet in depth from the surface of the tank through the sluice gates placed in the weir wall above described, the depth over the area would be 1.6 feet. It would be desirable to have sludge beds of twice the size shown.

COST.

The total estimated cost of the sewage purification works is $70,059.87.

The total cost of all the improvements is summarized by the consulting engineer as follows:

Intercepting sewers	$49,522 50
Sanitary sewers throughout the city	61,293 00
Sewage purification works	70,059 87
Storm sewers which should be constructed within the next five years	40,000 00
	$220,875 37

At a meeting of the State Board of Health, held October 14th, 1909, these plans for proposed changes in the sewerage system new sewers, and sewage purification works, submitted on September 28th, 1909, by Mr. Alexander Potter of New York City, consulting engineer, were approved upon the following conditions:

1st. That detail plans of storm water overflows, pumping station with screen chamber, and sewage purification works, be submitted to and receive the approval of the engineer of the State Board of Health before construction is begun:

2nd. That samples of all filtering material be submitted to and receive the approval of the engineer of the State Board of Health before being put in place;

3rd. That the area of the sludge beds be doubled;

4th. That devices whereby the filter effluent may be disinfected be placed along the effluent channel from the filters; and,

5th. That this approval be considered void unless construction on the intercepting sewer and purification works shall have been begun by June 1st, 1911.

REPORT ON PROPOSED SEWER FOR WEST LAFAYETTE.

On March 27, 1909, a request was received from Mr. George B. Adams, mayor of West Lafayette, for approval of a combined sewer to be constructed in that village. An examination was made on the ground June 25, 1909, by a representative of the engineering department. The following report was submitted:

West Lafayette is a village of about 1,000 population in the eastern part of Tuscarawas County on the south bank of the Tuscarawas River. It is a farming center and also has two large enameled ware factories. But few municipal improvements have been made and the village is still without a public water supply, sewerage, and paved streets.

It has been proposed by the county commissioners of Tuscarawas County to construct a drainage tile extending through the corporation for the purpose of draining a shallow pond known as Prairie Pond lying just to the southward of the corporation. The cost of construction of such a drain (estimated at $12,000) is expected to be met jointly by the village and the county, the portion to be paid by the village being $4,000. In order to secure the greatest possible advantage from the tile drain, the village authorities propose that its route be altered somewhat so that it will pass through the main street of the village where it may be used for carrying off surface drainage and sanitary sewage. The route as finally selected passes in a northerly direction through Center Street to Platt Street, thence in a westerly direction to Kirk Street, thence in a northerly direction to Plain Hill, a bit of elevated land which the proposed sewer must encircle before discharging into the Tuscarawas River. The final outlet is contemplated at a point about one-half mile westward of the intersection of the extension of Kirk Street and the river. This location was selected as being the most suitable with respect to the current of the stream for carrying away rapidly the discharge of the sewer.

For the purpose of making the sewer more acceptable for carrying off sanitary sewage, it is to be constructed through the village of 24-inch vitrified pipe laid with cemented joints. It is also to be so arranged that laterals may be connected thereto as needed. The approximate amount of sanitary wastes which may be expected to reach the sewer within a year after its construction could not be estimated. In addition to sanitary wastes, it is expected that the sewer will receive a small quantity of pickling liquors from the enameled ware factories.

CONCLUSIONS.

In view of the fact that the Tuscarawas River already receives a large amount of sewage contamination which at points give rise to nuisance and also affects the present water supply at Zanesville, it does not seem advisable to permit the discharge of additional sanitary drainage into this stream unless provision be made for purification of such wastes at least within a reasonable length of time. In order that purification may be economically carried out, it is necessary, more especially in the case of small communities, that the sewerage system be constructed on the separate plan. It would, therefore, seem inadvisable to permit the construction of the proposed sewer as a combined sewer, but there can be no objection to its use as a strictly ground and surface water drain.

July 10th, 1909, the State Board of Health approved this sewer, beginning at Prairie Pond, extending through Center Street to Platt Street, thence west through Platt Street to Kirk Street, thence in a northerly direction to Plain Hill, thence encircling the hill and discharging into the Tuscarawas River at a point about half a mile west of Kirk Street, provided:

1st. That before the contract is awarded for the construction of said sewer, the council of West Lafayette pass an ordinance strictly prohibiting house connections thereto and also prohibiting its use for the reception of sink drainage, cesspool overflows, or any domestic or sanitary wastes other than ordinary street washings; and,

2nd. That if construction on the proposed sewer is not begun before August 1st, 1910, this approval be considered void.

REPORT ON PROPOSED SEWER FOR WEST MILTON.

A request was received from Mr. Walter S. Kessler, village attorney of West Milton, for approval of the State Board of Health for a proposed new sewer to be used in carrying off domestic drainage. On July 8, 1909, one of the engineering assistants visited West Milton for the purpose of obtaining information relative to the exact location of the proposed sewer. The following report was submitted:

West Milton is a village of about 1,600 population, in the southwestern portion of Miami County and on the west bank of the Stillwater River. The area within the corporation limits is about 0.85 square mile. The surrounding country is mildly undulating and has a general slope toward the river. Back of the village this slope is gentle, but from the village to the river bank, an average distance of 800 feet, the fall is 80 to 100 feet. The village appears to be very progressive; the streets and lots are clean and neatly kept. The public water supply at present in use is obtained from a spring under a farm house just west of the village. This supply while at present free from injurious pollution, is liable to deteriorate in quality owing to the proximity of sources of possible pollution.

There are no industries in West Milton of importance, and the population is made up mostly of farmers and merchants.

Existing Sewers and Previous Action of the State Board of Health.

In May, 1906, the attention of the State Board of Health was called to the existence of a number of sewers which had been constructed in West Milton for sanitary purposes without having been submitted to the State Board of Health for approval. An investigation made by the assistant engineer on June 7, 1906, revealed the fact that there were about five or six sewers, all discharging directly into Stillwater River at the most convenient points. Owing to the improper construction of the outlets, more or less nuisance is being created by the discharge of sewage on the banks of the stream and its retention near the banks in pools away from the influence of the main current of the stream. As a result of this investigation, a letter was written to the local authorities pointing out that before constructing additional sewers it would be necessary to secure the approval of the State Board of Health, and it was further advised that a competent consulting engineer be retained for the purpose of designing a complete system of sewers for the entire village whereby all of the sewage might be conducted to a single point at a suitable site and proper elevation for the installation of purification works. In accordance with this advice, plans were submitted on January 15, 1907, providing for an intercepting sewer so located as to be able to intercept the sewage from the entire village and conduct it to a single point as recommended. It was not proposed that this sewer be built at once but that its proposed location and grade serve as a guide for the construction of future tributary sewers. These plans were approved by the Board, notice of which action was sent to the local authorities in the following letter:

"COLUMBUS, OHIO, January 28, 1907.

"*To the Board of Trustees of Public Affairs, West Milton, Ohio.*

DEAR SIRS: The State Board of Health has considered plans for a sewerage system for the village of West Milton, as shown on drawings submitted by Mr. John W. Dowler, consulting engineer, on January 15th, 1907.

"You are hereby notified that at a meeting of the State Board of Health, held January 23rd, 1907, said plans were approved, provided that sewage purification works of a design satisfactory to said Board be installed and operated when this is deemed necessary by the State Board of Health.

Yours truly,
(Signed) C. O. PROBST,
"By order of the Board. *Secretary.*"

Proposed Sewer. It is now proposed to construct a new sewer in Water Street in the southern part of the village and provide same with a temporary outlet into Stillwater River. It is not probable that the quantity of sewage reaching the proposed new sewer will be great, and there is ample flow in the stream to prevent nuisance provided the outlet of the sewer is conducted well out into the channel of the stream. The installation of the proposed sewer would, therefore, seem not to be objectionable provided it is understood by the local authorities that the intercepting sewer and purification works must ultimately be built.

At a meeting held August 5th, 1909, the State Board of Health approved this proposed sewer in Water Street, provided:

1st. That the outlet of the sewer be extended well into the channel of the stream by means of a securely placed iron pipe;

2nd. That when in the opinion of the State Board of Health such a course becomes necessary, the village build the intercepting sewer already approved by the State Board of Health, together with sewage purification works; and,

3rd. That this approval be considered void unless construction of the proposed sewer shall have been begun before September 1st, 1910.

REPORT ON PROPOSED SEWERAGE AND SEWAGE PURIFICATION FOR WILBERFORCE UNIVERSITY.

On September 11, 1909, plans were submitted by Messrs. Bradbury and Shute of Columbus, consulting engineers, for a system of sewerage and sewage purification for Wilberforce University. In anticipation of the receipt of plans, the acting chief engineer visited Wilberforce on August 13, 1909, to make the necessary inspection. The following report was submitted:

Wilberforce University is an institution for colored students lying about four miles to the northwestward of Xenia. The present number of students that attend the college is about 300, but it is expected that this will be increased in the near future to 350. The growth of the university is not expected to be rapid, and the number of students will not exceed 500 within the next few years. Wilberforce University has four main buildings, also manual training shops, armory, laundry, and a power house. Nearly all of the students live in dormitories connected with the main buildings.

The buildings are grouped on a campus of comparatively level land and at a somewhat higher elevation than the surrounding country. Beyond the campus and back of the buildings is a deep ravine with precipitous slopes, in which flows a very small stream fed by springs. The springs serve as a source of water supply for the institution, the water being pumped to the various buildings and stored in suitable tanks. This stream is tributary to a small creek about half a mile beyond, which in turn discharges into the Little Miami River north of Xenia. Hitherto the small stream in the ravine above referred to has received the discharge of all sewage and storm water drainage from the university, conveyed to it in a rather crudely constructed system of combined sewers. Owing to a nuisance being created in the ravine by the discharge of sewage, and also for the reason that it is desired to install in the university additional plumbing fixtures, the authorities of the institution have decided to build a more adequate system of sewers together with sewage purification works.

QUANTITY OF SEWAGE.

The quantity of sewage at present flowing from the institution is extremely small, due very probably to the existence of but few plumbing fixtures. Rough gaugings made and checked by water consumption show a flow of but 4500 gallons per twenty-four hours, or 15 gallons per capita. It is believed, however, that with the installation of additional plumbing including baths, etc., the flow of sewage will become more nearly normal and perhaps reach 85 gallons per capita, representing a total flow (based on a population of 350) of about 30,000 gallons per twenty-four hours.

SEWERS.

The proposed new sewerage system comprises 1260 feet of 8-inch pipe and 875 feet of 6-inch pipe, or a total of 2135 feet. The sizes of sewers used will readily permit of an ultimate population tributary of 1000. It is expected that the sewers will be constructed in accordance with best practice. All pipe will be of vitrified tile laid with carefully cemented joints. Manholes will be placed at all changes of grade and direction, and flush tanks will be placed at the head of sewers if it is found that they are needed after the system has been placed in use.

PURIFICATION WORKS.

The purification works will be located in the ravine back of the campus at a point fully 400 feet removed from the nearest habitation. The location is well selected as it is far removed from possible building sites, and is further screened from general view by a dense growth of trees. The elevation of the site is such as to permit the effluent from the plant to flow into the stream with a good fall even during high stages. The purification works will comprise a screen chamber, two sedimentation tanks, one dosing chamber, and four intermittent sand filters.

Screen Chamber. The screen chamber will be built of concrete, will be 3 feet wide, 2 feet 4 inches long, and about 1 foot in depth below the flow line. It will be provided with one inclined screen made up of ½-inch round bars with 1-inch clear openings. The arrangement of the screen is such that it may readily be cleaned by means of a rake. The screen chamber will be protected by a suitable wooden cover on hinges.

Sedimentation Tanks. From the screen chamber the sewage will pass through a short channel and thence over triangular weirs into the sedimentation tanks. The sedimentation tanks will be built of concrete, reinforced where necessary, and each will have the following dimensions: Length, 12.1 feet; width, 5.5 feet; depth to flow line, 8 feet. These dimensions represent a combined capacity for the two tanks of approximately 4,000 gallons, or 6½ hours' flow based on a daily sewage flow of 30,000 gallons. In each tank the triangular weir over which the incoming sewage must flow is placed in one corner, and the outlet of the tank (formed by a rectangular notch in the end wall) is placed diagonally opposite thereto. Hanging baffles placed in front of the inlet and outlet of each tank cause the sewage to enter and be drawn off at approximately mid-depth. To prevent the dissemination of odors from the tanks, they are covered by means of a concrete slab roof with a manhole in the center. No sludge drains are provided as it is thought that the most convenient way of removing the sludge from so small a plant is to pump it out by hand and cart it away in suitable tank wagons.

Dosing Chamber. Directly adjoining and extending across the outlet ends of the two dosing tanks is the dosing chamber which has the following dimensions: Length, 12 feet; width, 7 feet; depth to flow line, 5 feet. These dimensions represent a capacity of 3140 gallons, or approximately 2.3 hours' flow. Thus the combined storage capacity of the sedimentation tank and dosing chamber represents 8.8 hours' flow. The dosing chamber will be equipped with two 5-inch Miller alternating siphons. The dosing chamber also will be covered with a reinforced slab roof provided with a centrally placed manhole.

Filters. The intermittent sand filters are four in number, arranged in two groups of two filters each. Each siphon will discharge into a manhole from which the sewage may be diverted on to either or both filters of the respective groups. The filters are somewhat irregular in shape but all have the same surface area. The total area measured at the sand line is 2/9 of an acre, which area will provide for a tributary population per acre of 1575. This figure is somewhat large, but with the present low flow of sewage it should prove ample for present needs. At any rate, provision has been made for two additional filters should these prove necessary. With the two additional filters, the arrangement of all the filters with respect to the siphon discharge will be in groups of three. The diverting manhole will be so designed that sewage may be diverted on to any or all of the filters in each group. The filtering material has not as yet been definitely decided upon but will probably be local bank sand. The sand bed will be 2½ feet in thickness and will be underlaid by a stratum of graded gravel varying in thickness from 6 inches to 9 inches, the greater depth being at the underdrains. Each filter will be underdrained by means of two lines of 6-inch vitrified sewer pipe laid with open joints. Each line of underdrains will discharge independently into the adjoining stream.

COST DATA.

The estimated cost of the system of sewers is $1335; the estimated cost of the purification plant is $1435, making a total of $2770. These figures are very low and are made possible by the fact that much of the labor will be done by the students at the university.

On October 4th, 1909, the State Board of Health approved these plans for sewers and sewage purification for Wilberforce University, submitted September 11th, 1909, by Messrs. Bradbury and Shute of Columbus, consulting engineers, upon the following conditions:

1st. That the purification plant be enlarged in a manner and to the extent deemed necessary by the State Board of Health, when in the opinion of said Board the plant is no longer capable of producing a satisfactory effluent;

2nd. That samples of the filtering material be submitted to and receive the approval of the engineer of the State Board of Health before such material is put in place; and,

3rd. That this approval be considered void unless the sewers and sewage purification plant are completed by October 1st, 1911.

REPORT ON PROPOSED SEWER IN POLAND AVENUE, YOUNGSTOWN.

On April 27, 1909, there was submitted by Mr. F. M. Lillie, city engineer of Youngstown, a plan showing a proposed sewer in Poland Avenue. This plan was referred to the engineering department and was reported on as follows:

The district of Youngstown which it is proposed to drain by the proposed sewer in Poland Avenue, contains at present about 900 people. This population, it is estimated, may reach 5,000 within twenty years. The district covers about 150 acres and is located in the southeasterly part of the city.

The proposed sewer is to be located entirely in Poland Avenue, except a few hundred feet of the outlet sewer which will enter the Mahoning River at two points; at Gibson Run and at Hill Street. The reason for two outlets is to prevent the deep excavation which would be necessary if the sewage were all conveyed to one point. In addition to the outlets proposed, there will be a storm water overflow into Gibson Run at a point a few hundred feet west of Poland Avenue.

The proposed sewer will be constructed of both pipe sewer and brick, as follows:

Pipe Sewer,	1,500 feet.	15-inch.
	500 feet.	18-inch.
	2,100 feet.	20-inch.
	1,000 feet.	24-inch.
Brick Sewer,	1,800 feet.	30-inch.
	450 feet.	36-inch.

The sewer is designed to care for a rainfall of one inch per hour from the district drained, and the overflow will come into action when the discharge of sewage exceeds an amount represented by the rainfall of ¼ inch. It is expected that some 300 people will connect with the sewer immediately. This probably represents a daily flow of 15,000 gallons. The estimated cost of the sewer to be constructed at present is $18,000.

The pollution of the Mahoning River by Youngstown and by cities and villages above has been a serious problem for several years and is ever increasing in importance. The State Board of Health has recently conducted extensive investigations as to the condition of the river and sources of pollution thereof. Evidence collected during these investigations, as well as evidence obtained previously, shows that the flow of the river below Youngstown, due largely to the use of the water by steel plants, becomes very small during dry weather. At certain points below the city the entire flow is made up of sewage, and very foul and offensive conditions are created.

The following is a statement of the previous actions of the State Board of Health concerning proposed sewers in Youngstown.

> "In 1899 the Board approved a storm water sewer in Spring Street to receive sewage from existing overflows in Elm Street and Bryson and Wick avenues. At the same time the Board disapproved plans for Sewer District No. 11.
>
> "In 1903 the Board approved plans for Sewer District No. 7, provided 'that satisfactory purification shall be installed whenever deemed necessary by the State Board of Health.'
>
> "In 1904 the Board approved plans for proposed sewer in McGuffey Street, with temporary outlet into Crab Creek, provided 'that the city of Youngstown agrees, by corporate action, to build a satisfactory intercepting sewer for Crab Creek district when, in the opinion of the State Board of Health, such action becomes necessary.' "

The additional pollution from the construction of the proposed sewer in Poland Avenue could not probably be detected in the already grossly polluted stream. Nevertheless, it would seem that some remedial measure should not be taken and that no additional pollution, however small in itself, should be allowed unless the city at the same time takes some steps toward the purification of its sewage.

At a meeting held June 16th, 1909, the State Board of Health approved this plan, submitted by Mr. F. M. Lillie, city engineer, April 27th, 1909, provided:

1st. That the city council first pass an ordinance providing for a general preliminary report on the problem of sewage purification for Youngstown, with special reference to securing a suitable site for future purification works; and,

2nd. That such report be submitted to the State Board of Health for its approval not later than January 1st, 1910.

REPORT ON PROPOSED SEWERAGE AND SEWAGE PURIFICATION FOR THE OHIO SOLDIERS' AND SAILORS' ORPHANS' HOME, NEAR XENIA.

On August 10, 1909, plans and specifications for sewerage and sewage purification for the Ohio Soldiers' and Sailors' Orphans' Home near Xenia, were submitted by The Cleveland Engineering Company of Cleveland. These plans were reviewed by the engineering department and the following report was made:

GENERAL STATEMENT.

The Ohio Soldiers' and Sailors' Orphans' Home is situated on a 290-acre tract of land near the C. H. & D. Railroad about one mile southeast of Xenia. The institution comprises an administration building, two school houses, four hospital cottages, a laundry, an industrial building, several power houses, 33 cottages, several slaughter houses, farm buildings, and a number of smaller outbuildings. The normal population of the institution is approximately 1,000, of which about 200 are officers, teachers, and attendants. During the summer the population is materially less and is roughly estimated at about 800. It is not likely that the institution will increase in size, though there has been some consideration of combining with it the Home of the Ohio Soldiers, Sailors, Marines, Their Wives, Mothers and Army Nurses, now at Madison.

The institution is well supplied with modern conveniences, including gas, electricity, a central heating plant, a water supply, and sewerage. The water supply is derived from two sources; namely, Shawnee Creek and deep wells. The two supplies are delivered through separate pipes. The creek water is used about the institution for boiler feed, hot water for domestic and laundry purposes, for power in connection with organ and elevator, for flushing a few outdoor closets, and other miscellaneous purposes. The well supply is used for drinking and cooking, and for domestic purposes where the water is used cold. It is also extensively used for closet flushing and to some extent in the laundry. Inasmuch as the creek water is not distributed through the buildings excepting at a high temperature, it is not likely to be used for drinking purposes.

REVIEW OF PAST ACTIONS OF THE STATE BOARD OF HEALTH RELATIVE TO THE SEWERAGE OF THE INSTITUTION.

The sewerage problem at the institution first came to the attention of the State Board of Health in 1900 through a complaint of the trustees of Xenia Township, Greene County, requesting an investigation by the Board of a nuisance created in Shawnee Creek by the discharge therein of the sewage from the institution. In accordance with this petition, the institution was visited in January, 1900, by a committee composed of a member of the Board and the engineer. The conditions found by the committee were briefly as follows: All of the sanitary and domestic sewage of the institution. including some storm water, was being collected in a large underground tank having a capacity of about 47,000 gallons, whence it was being pumped to open pits about 3 feet deep, 20 feet wide, and perhaps several hundred feet long, on farm land belonging to the institution. It was expected that the sewage would be diverted from these pits for irrigation purposes or permitted to leach away into the soil. A considerable quantity of sewage, however, was permitted to flow to the southward and enter a small stream known as Gladys Run. The pump used for raising the sewage from the underground tank was not of large enough capacity to take much more than half the entire flow, and the remaining sewage was permitted to overflow and find its way into Shawnee Creek through an old outfall sewer which formerly carried off all the sewage of the institution. It was found that a gross nuisance was being created in both streams. In the case of Gladys Run, which flowed through farm land and was to some extent used for irrigation purposes, there was no objection by riparian owners at that time to the contamination; but in the case of Shawnee Creek, which passes through a rather extensive residential district, complaints of nuisance were persistently made. The committee's report pronounced the conditions found as a decided nuisance and recommended that steps be taken for its abatement. A copy of the report was transmitted to the trustees of the institution.

No changes having been made by July of the same year, a second complaint was submitted to the State Board of Health. A second investigation was made on July 14, 1900. This second investigation revealed practically the same conditions found during the first investigation, though the nuisance created was greater owing to warmer weather. In order to learn what might be done to enforce the abatement of the nuisance, the matter was submitted to the attorney-general who gave as his opinion that inasmuch as the institution belonged to the state, there were no legal proceedings that could be taken requiring it to abate the nuisance. It was possible for the aggrieved parties, however, to bring suit against the trustees of the institution for damages, but this would not abate the nuisance. The second report prepared by the committee was sent to the trustees of the institution and in reply a communication was received stating that it was the intention of the trustees to use every possible means to obtain funds to properly care for the institution's sewage.

It is understood that following this period a larger pump was installed and certain changes were made in valve and pipe connections whereby the entire sewage flow might at most times be pumped into Gladys Run. At a later period complaints were received from riparian owners along Gladys Run, and nuisances were also again created along Shawnee Creek by the occasional discharge of sewage during breakdown of the pumps or unusually large flow, so that the trustees of the institution felt constrained to call upon the legislature for funds sufficient to install sewage purification works. This petition having been successful, The Cleveland Engineering Company was engaged to prepare plans.

INFORMAL ADVICE AND PRELIMINARY INVESTIGATION BY THE STATE BOARD OF HEALTH.

During the early part of July, 1909, a representative of The Cleveland Engineering Company called on the engineer of the State Board of Health for the purpose of discussing preliminary plans. The system proposed at that time was sedimentation followed by sprinkling filters. Informal advice was given to the effect that a sprinkling filter plant under the local conditions would not prove the most satisfactory, and intermittent sand filtration was recommended. A second representative of The Cleveland Engineering Company called upon the engineer of the Board July 17, 1909, with a second set of plans. These plans were discussed and certain changes relating to the capacities of tanks and areas of filters were informally recommended. On August 5, 1909, an informal conference was held at Warren between a representative of the engineering company and the secretary and engineer of the State Board of Health relative to a third set of revised plans. At this time further informal recommendations were made in connection with certain details of design of a minor character. The Cleveland Engineering Company was informally advised that it would be feasible to proceed with preliminary arrangements of letting of contract before receiving the final approval of the State Board of Health.

On August 13, 1909, the engineer of the Board visited the Ohio Soldiers' and Sailors' Orphans' Home for the purpose of making an inspection on the ground principally with reference to the site proposed for the purification works.

BRIEF DESCRIPTION OF PLANS AS FINALLY SUBMITTED.

The plans as finally submitted comprise additional sanitary and storm sewers and sewage purification works. The sewage purification works include screening, sedimentation, and filtration through intermittent sand filters. Three sedimentation tanks are shown having a total approximate capacity of 54,000 gallons, and six sand filters are shown having a total area of approximately one acre. The screened and settled sewage will be diverted on to the sand filters by means of automatic siphonic apparatus. Sludge from the settling tanks will be treated on a specially prepared sludge bed.

SEWERS.

The proposed additional sewers comprise 3,700 feet of sanitary sewers and 4,300 feet of storm sewers. The former will range in size from 6 to 12 inches in diameter, and the latter from 8 to 18 inches in diameter. With the completed system, the total length of sanitary sewers will be 7,500 feet, and the total length of storm sewers will be 6,900 feet. The proposed sewers (as is the case with existing sewers) will be constructed in an approved manner of vitrified sewer pipe laid with cemented joints and will have manholes placed at all changes of grade and direction.

SEWAGE FLOW.

The present sewage flow is abnormally large and is estimated from a series of measurements made by the consulting engineers at about 160,000 gallons per twenty-four hours. This large flow is probably due to the discharge into the sanitary sewers of a considerable quantity of storm water, more or less clean water from various sources that should preferably be discharged into storm sewers, and a large quantity of water due to careless waste throughout the institution. It is proposed in connection with the new installations to cut down this abnormally large flow by diverting all storm water, cistern overflow, and other clean water into the storm sewers and preventing as far as possible unnecessary waste. With these changes, it is not believed that the daily domestic sewage flow will exceed 100,000 gallons; that is, a flow of approximately 100 gallons per capita, a very liberal provision for an institution of this character. In the following discussion, therefore, it will be assumed that the plant will have a nominal capacity for treating sewage from 1000 persons producing 100 gallons of sewage each.

DETAILED DESCRIPTION OF PURIFICATION WORKS.

Site. The site selected for the location of the sewage purification works is in the northwest corner of the grounds. In some respects this site is not altogether desirable inasmuch as it is but 250 feet removed from the chapel of the institution and but 400 feet removed from the nearest dwelling. Other than this there are no buildings within 600 feet. Beyond 600 feet to the northwest, however, there is a considerable built up district constituting a portion of Xenia. On the other hand, it is the only location that may be utilized without pumping the sewage. Further, the design of the purification works is such that odors therefrom will not be carried to great distances. The probability of odors being disseminated in the neighborhood is still further minimized by the fact that at this institution the works will receive very careful operation. One specially favorably feature of the proposed site is that it is well above the influence of flood water in Shawnee Creek. The difference of elevation between average high water in the creek and the effluent drain from the plant will be approximately 18 feet. All things considered, it is believed that the site will prove quite satisfactory.

Screen Chamber. Sewage from the main 12-inch outfall sewer will be received in a small screen chamber 4 feet wide, 6 feet long, and about 2 feet 9 inches in depth to the flow line. This chamber will be provided with two screens made up of ½-inch round iron bars. The first screen will have clear openings between the bars of 1 inch, and the second will have clear openings of ½-inch. The screens are to be so placed that they may be readily cleaned by means of a rake. Just beyond the screens will be placed a partition supporting a measuring weir whereby measurements of the sewage flow may be obtained at all times. Beyond the measuring weir will be an outlet into a 12-inch by-pass whereby the screened sewage may be diverted directly to Shawnee Creek. The sewage will normally pass through three 6-inch pipes leading to the sedimentation tanks, each controlled by a valve placed within the screen chamber.

Sedimentation Tanks. Each of the three sedimentation tanks will be 30 feet long, 10 feet wide, and about 8 feet in effective depth to the flow line. These dimensions represent a capacity of 54,000 gallons for the three tanks, or based on the nominal capacity of the plant about 13 hours' flow. The period of flow may of course be varied by throwing out one or two of the tanks. The tanks will be covered with a reinforced concrete roof with a view to preventing as far as possible the dissemination of odors. Near the inlet and outlet ends of the tanks will be placed hanging baffles reaching to approximately mid-depth, for the purpose of distributing the flow of sewage across the width of the tank. At the outlet end of each tank will be placed a weir which can readily be made adjustable so that the quantity of sewage flowing through the tanks can be regulated. The floor of each tank will be sloped toward a central sludge outlet controlled by a valve. This outlet will lead into a system of 8-inch tile which conveys the sludge to the sludge bed. The interior of the tanks will be made accessible by manholes placed at inlet and outlet ends and in the center over the sludge drain. The effluent from the sedimentation tanks will be received in a collecting channel also covered and made accessible by a manhole. From the collecting channel, the sewage will be conveyed through an 8-inch sewer pipe to the dosing chamber.

Dosing Chamber. The dosing chamber will be placed at the center of the group of filters. It will be 12 feet wide, 15 feet long, and 5 feet deep to the flow line, which represents a capacity of 6750 gallons or a period of flow of 1.6 hours. The chamber will be covered over by a reinforced concrete roof provided with manholes for accessibility to the interior. The automatic apparatus will consist of six alternating Merritt siphons, one tributary to each filter.

Filters. The six filters will be arranged in two groups of three each. Each filter will be 80 feet by 90 feet at the sand line, representing 0.165 acre, or a total area of 0.99 acre. This area provides for a population tributary of somewhat over 100,000 gallons per acre per day.

The filtering material will consist of sand which it is hoped to obtain from a nearby sand bank. The quality of the sand in the bank is such, however, that screening and washing may prove necessary. Before being placed, it is the intention of the consulting engineers to submit samples for the approval of the State Board of Health. The sand layer will be 3 feet 3 inches in thickness and will be underlaid by a layer of gravel varying from 3 to 9 inches. The variations in the thickness of the gravel correspond to ridges and valleys in the bottom of the filter to facilitate the flow of effluent to the underdrains which are placed in the valleys.

Across each bed will be laid three 6-inch drains with short tributary 4-inch laterals. The three main drains will in turn be tributary to an 8-inch main drain serving one group of three filters. All underdrains will be made of vitrified sewer pipe with bell and spigot ends laid with open joints. The two 8-inch drains from each group of three filters unite in a common manhole, whence the sewage is conveyed through a 12-inch outfall sewer into a small ditch which in turn discharges into Shawnee Creek about 600 feet beyond.

The sewage will be distributed upon the surface of the filters by means of enclosed vitrified pipe distributors laid with cemented joints. These distributors will discharge at about four points approximately equidistantly spaced on each bed. The distributors will be so adjusted as to deliver an approximately equal quantity of sewage at each point of discharge. The enclosed type of distributor is thought advisable as an additional preventive to the dissemination of odors.

Sludge Bed. The sludge bed shown on plans is 30 feet long by 20 feet wide at the sand line, thus giving it an area of 600 square feet. It is to be constructed in all essentials like the sand filters. Inasmuch as the discharge from one of the sedimentation tanks on to this area will cover it to a depth of 4 feet, it is believed that the area is insufficient and should be enlarged fully four times.

COST.

The estimated cost of the proposed additional sewers is $6,000, and the estimated cost of the purification works is $9,000.

August 23rd, 1909, the State Board of Health approved these plans for sewerage and sewage purification for the Home, submitted August 10, 1909, by The Cleveland Engineering Company, upon the following conditions:

1st. That samples of filtering material be submitted to and receive the approval of the engineer of the State Board of Health before being placed;

2nd. That the area of the sludge bed be increased to 1200 square feet; and,

3rd. That this approval be considered void unless construction shall have been begun by January, 1910.

October 6th, 1910, samples of sand were approved by the engineer of the Board for use as filtering material in the sewage plant. These samples were designated as bay sand, lake sand and coarse sand, respectively.

INVESTIGATION UNDER THE BENSE ACT

(99 Ohio Laws, Page 74, Sections 1249-1261 inclusive, General Code.)

REPORT ON INVESTIGATION OF THE AKRON WATER SUPPLY UNDER THE BENSE ACT.

On July 9th, 1909, the following communication was received from the board of health of Akron:

> "*The Board of Health of the State of Ohio, Columbus, Ohio.*
>
> GENTLEMEN: This will advise you that at a meeting of the board of health of the city of Akron, the following resolution was passed, that in the belief of the board of health of the city of Akron, the public water supply of the city of Akron is impure and dangerous to health. By direction of the local board of health, I am directed to advise you of this resolution, and to request that you take action proper in the premises as provided by Ohio Laws, Vol. 99, page 75.
>
> Kindly advise me of the receipt of this letter, and also any further advices deemed necessary in the premises.
>
> Very respectfully yours,
> THE BOARD OF HEALTH OF AKRON, OHIO.
> By (Signed) H. A. KASSON, *Clerk.*"

The President of the Board on July 12th, 1909, appointed Mr. Hartzell, member, and the acting chief engineer, a committee to make the investigation. Akron was visited by the committee on July 19th, and later more extended field tests were made by assistants in the engineering department. The following report was made:

The water supply of Akron has already been described in detail in a report entitled "Present and Proposed Water Supply of Akron," under date of February 14th, 1906, and a report entitled "Proposed Change in Water Supply of Akron," under date of February 10th, 1909. Briefly, the main source of supply is Summit Lake which is used primarily as a canal feeder. Owing to the objectionable quality of the water derived from this lake, the water company has from time to time endeavored to obtain a supply from ground sources. These attempts have, however, generally failed owing to the inadequate quantity of ground water available. The latest attempt at securing a ground water supply was made in 1906 when a large number of wells, some 70 in all, were drilled to the southward of what is known as Water Works Park. Within a year, however, it was plainly evident that these wells could not yield a sufficient quantity of water to meet all demands. The expedient of increasing the yield of the wells by permitting lake water to flow into certain of them while pumping from others proved also to be a failure due to the rapid clogging of those wells receiving lake water.

At the present time Summit Lake water is the main source of supply but is supplemented to some extent by water from the wells. It is claimed that the approximate proportion in which well and lake water are furnished is about one to two; however, all analyses of tap water recently made indicate practically all Summit Lake water.

During the committee's visit on July 19, 1909, samples were collected at a point in Summit Lake approximately over the water works intake, at the inlet to Summit Lake from the canal feeder, and in the canal feeder at a point well above the influence from the discharge of wastes from the salt works and rubber works; also one sample was collected from a tap on the mains. While the analyses show at the inlet of Summit Lake a considerable amount of dangerous contamination, yet the water taken from over the intake as has been the case in a number of previous samples analyzed in the laboratories of the State Board of Health, showed no marked indications of objectionable contamination. It appears from a comparison of samples taken at the inlet to Summit Lake and at a point above the salt works and rubber works, that the great portion of the contamination enters in the vicinity of these works. The evidence on the whole showing injurious contamination of the public water supply in a manner dangerous to health was rather weak, and inasmuch as the Bense Act gives the State Board of Health authority only over such public water supplies as "are dangerous to health," more extended information seemed desirable. Such information relates to the following three points:

(1) State of the currents and quantity of water passing through Summit Lake.

(2) The collection of a series of samples extending over a period of time long enough to take in all conditions of wind and currents obtaining in Summit Lake.

(3) A thorough sanitary inspection of the watershed.

Accordingly, assistants from the engineering department visited Akron and under instructions from the committee conducted a series of tests extending over a period of three weeks. There has not as yet been time to compile all of the results of these tests in report form, but a study of the essential facts warrants the committee in making definite recommendations at the present time.

With regard to the state of currents and the quantity of water passing through Summit Lake, it may be said that the main current passes through the center of the lake and not directly over the water works intake. However, float measurements indicated that this current is not so strong but what the movement of the water is readily affected by the wind movements. It is thus possible with a southwesterly wind for the polluted water entering the lake to drive directly over the location of the intake. This possibility is brought out by analytical results which show a great variation in the quality of the water over the intake. The quantity of water passing through the lake is sufficient to prevent storage for a long enough period to insure the complete self-purification of the water in the lake.

In regard to the analytical data, the results correspond in a general way to those previously obtained but show a greater variation in the quality of the water over the intake than has hitherto been observed. It was also found that this variation is greatest at the elevation from which the intake draws. Owing to the large amount of vegetable organic matter contained in the water of Summit Lake and tributary lakes and channels, and also owing to the fact that the normal chlorine content is obscured by salt water discharged into the canal from the salt works and rubber works, the chemical analyses furnish but little information relative to the character of the contamination. It is, therefore, necessary to rely almost wholly on the results of bacterial analyses. Samples taken from Summit Lake near the surface and above the intake show a variation in bacterial content from 100 to 6,600, with an average of 960. In 20 determinations the colon bacillus was found 5 times in one c. c. and 10 times in 10 c. c., or a total of 15 times out of 20. In the case of water taken from Summit Lake at a depth of about 30 feet below the surface near the point of intake, the bacterial content varied from 120 to 180,000, with an average of 11,700. Out of 19 determinations for the colon bacillus, it was found present in both one and 10 c. c. portions 6 times, or a total of 12 times in all. At the entrance to Summit Lake in the Ohio Canal, the water was visibly much more polluted than in the vicinity of the intake, and the bacterial results ran very much higher. However, the coli determinations were scarcely worse than those found near the intake. Out of 20 determinations, the colon bacillus was found present in one c. c. 9 times and in 10 c. c. 7 times, or 16 times in all. At the remaining two regular sampling points, namely, in the Ohio Canal above the influence of contamination entering near the salt works and rubber works, and at the outlet to Long Pond, the results approximated those obtained near the water works intake though the bacterial content was somewhat more favorable. The colon bacillus, however, was frequently found in the Ohio Canal and occasionally found at the outlet to Long Pond. On the whole the analytical findings are distinctly unfavorable to Summit Lake as a source of public water supply.

Referring now to the sanitary inspection of the watershed, both Long Pond and Summit Lake have their banks lined with summer cottages and pleasure resorts. It is true that special precautions are taken to prevent the entrance into the water of sewage and other objectionable matters; nevertheless with so dense a population as shown, it is hardly likely that occasional contamination can be avoided. The most serious source of contamination is from a small stream known as Falor Ditch which enters the Ohio Canal just above the rubber works. This ditch has two branches, the southerly of which is dry during the greater part of the year and passes through practically uninhabited territory; the northerly branch, however, passes through a thickly populated portion of south Akron. It receives the discharge from one small storm sewer, but no sanitary sewage enters it directly. There is, however, abundant opportunity for intermittent contamination. Along its banks are located a number of privies from which during high water or heavy rains, fecal matter may be readily washed into the ditch. It was observed also that a large number of cuspidors from one of several factories located on the banks of the ditch, are washed in the ditch every day. It will thus be seen that this ditch constitutes a serious source of contamination, and this is abundantly borne out by analytical evidence.

A very careful inspection of the salt works and the rubber works failed to reveal any evidence of contamination of an objectionable character entering the canal. It is true that until recently the rubber works have been discharging into the canal quantities of rubber washings which constitute a very filthy liquid. However, all of the objectionable wastes both from the salt works and rubber works are now being pumped through suitable conduits into the Akron city sewers. It thus appears that the gross contamination which has a number of times been noted in the vicinity of the salt works and rubber works is really due to the pollution entering Falor Ditch rather than to the wastes from these works.

There is another source of contamination that cannot be entirely overlooked, namely, the very large number of boats and launches used on both Summit Lake and Long Pond and the connecting channels. None of these crafts are sufficiently large to carry cabins and toilets, but there can be no doubt that their use tends to increase the pollution of the supply drawn from Summit Lake. The motor boats in particular have a marked effect on the physical character of the water, for in passing through the canal which feeds Summit Lake, the agitation which they cause in the water badly erodes the banks of the canal and causes the water to become very turbid. This, however, is not a matter that has a special sanitary significance.

From the above it would appear that there is sufficient evidence to warrant the State Board of Health in requiring The Akron Water Works Company to purify the water which it takes from Summit Lake, or secure a new source of supply of satisfactory quality. It is understood, however, that there is a likelihood of the water works property being taken over by the city in the course of a few years. This transfer of ownership cannot take place before 1911 on account of the stipulations of the franchise which provides that the city may negotiate for the purchase of the water works only at five year intervals. Until the matter of city ownership is definitely decided, it would hardly be advisable to cause the water company to go to the expense of introducing a purification plant.

RECOMMENDATIONS.

In view of the foregoing, it is respectfully recommended by your committee that the owner of the Akron water works, whether this be the present company, a new company, or the city of Akron, be required to install and place in operation not later than July 1st, 1911, a water purification plant which will meet the approval of the State Board of Health; or secure a new source of supply satisfactory to said Board.

This report was presented to the Board and the Secretary was instructed to notify the owners of the water works of the Board's findings and that they might have an opportunity to be heard on January 19th, 1910, and show cause, if any, why they should not be required to install a satisfactory water purification plant or secure a new source of supply.

After such hearing the Board voted that the improvements or changes recommended in the report of its committee were necessary and should be made, but in view of the fact of the suit pending against the water company, which might enable the city of Akron to secure a pure and suitable water supply without action by the State Board of Health, that further proceedings be suspended until the decision of the court was reached.

REPORT ON INVESTIGATION OF A NUISANCE CAUSED BY IMPROPER SEWER OUTLETS AT COLLINWOOD.

On June 14th, 1909, there was received from the health officer of Collinwood, Dr. Jerome D. Dodge, the following petition:

"*To the State Board of Health.*

I, the undersigned, being the duly elected and qualified health officer of Collinwood, Cuyahoga County, State of Ohio, do hereby certify that on the 12th day of June, 1909, I adopted a resolution of which the following is a true copy:

Resolved, That the village of Collinwood, located in Cuyahoga County, Ohio, is discharging and permitting to be discharged sewage and other wastes into "Rockefeller Creek", otherwise known as the Lake Shore ditch, and by reason thereof has so corrupted said stream as to give rise to foul and noxious odors, thereby creating conditions that are detrimental to the health and comfort of the citizens of Collinwood, Cuyahoga County, Ohio, who reside in the vicinity of said creek or ditch.

The State Board of Health is hereby respectfully requested to investigate the conditions complained of, and to require the said village of Collinwood, Ohio, to install such works or means for purifying or otherwise disposing of its sewage and other wastes as may be determined by said board, in accordance with 'An act to authorize the state board of health to require the purification of sewage and public water supplies and to protect streams against pollution,' passed April 7th, 1908.

(Signed) Jerome D. Dodge, *Health Officer,*
5027 Granger Ave., Collinwood, Ohio."

Dated at Collinwood, Ohio, this 12th day of June, 1909.

On June 16th, 1909, the president of the board appointed the acting chief engineer a committee to investigate this complaint, and on July 6th, the committee visited Collinwood for the purpose of making an examination on the ground, in which he was assisted by Messrs. W. A. Miner, J. G. Plowman, E. H. Perry, members of council; Dr. Dodge, health officer, and Mr. C. G. McIlrath, chief of police. The following report was then made:

Collinwood is a village of about 4,500 population lying on the shore of Lake Erie just to the northeastward of the city of Cleveland. The community is mainly centered about the Lake Shore and Michigan Southern Railroad shops which employ something over 1,500 hands.

The installation of an extensive system of sewers to meet the entire needs of the village was begun in 1901, without having received the approval of the State Board of Health. This system of sewers is built partly on the separate and partly on the combined plan, and has cost to date $313,109. It was originally the intention to convey the entire sewage flow to a single point and discharge same into the lake 3,000 feet from shore through the new Cleveland outfall sewer. Had the original plans been carried out, the system of sewers would not have required the approval of the State Board of Health since no new outlet was involved. However, owing to lack of funds, the outlet was not constructed as originally proposed, but the sewers were permitted to discharge at several points along a small stream known as Rockefeller Creek flowing northward toward the lake and discharging near the point of proposed outlet. In addition to the village sewage, a considerable quantity of sanitary wastes are also discharged into the stream from the Lake Shore and Michigan Southern Railroad roundhouse. The natural flow in the stream is so small that it has become practically an open sewer and a decided nuisance in the neighborhood.

On June 7, 1909, a bond issue for $16,000 was submitted to a vote of the people, a portion of which (approximately $9,000) was to be devoted to completing the sewer outfall as originally proposed. Anticipating some difficulty in the passage of the bond issue, an investigation by a representative of the State Board of Health was requested on May 16, 1909, by the health officer with a view to obtaining a report that might be made public. This investigation was accordingly made by one of the engineering assistants on May 28, 1909, following which a letter embodying the results of the investigation was sent to the health officer June 4, 1909. This letter pointed out the unsanitary conditions caused by the discharge of sewage into Rockefeller Creek, and also pointed out that such discharge was illegal owing to the fact that the approval of the State Board of Health had not been obtained therefor. It was further suggested that in event of an adverse vote on the bond issue, the matter might be taken up under "An Act to authorize the State Board of Health to require the purification of sewage and public water supplies and to protect streams against pollution, passed April 7, 1908." In accordance with this suggestion and after the bond issue had been lost, the petition under which this investigation is made was filed with the State Board of Health.

Rockefeller Creek is fed by a drainage ditch extending along the Lake Shore and Michigan Southern Railroad. The tributary drainage area is not known. However, the flow of the stream during periods of dry weather is very slight and in extreme dry weather there is no natural flow at all. The first contamination reaching the stream is from the sewer leading from the Lake Shore and Michigan Southern Railroad roundhouse, where an average of about 75 men are employed. This sewer enters the creek, a short distance beyond where the stream is carried under the Lake Shore Railroad tracks and takes its course to the northward. The contamination from this sewer is sufficient to greatly alter the appearance of the water in the stream, even during periods of rather high flow. During dry periods, of course, the stream is practically an open sewer.

Below the point of outlet of the round house sewer, Rockefeller Creek passes through open fields, but at three points comes within 200 feet of dwellings. At Fulton Street the creek passes under the roadway through a stone culvert and at times gives rise to odors very objectionable to passerby. From Fulton Street to Westroop Street the creek has a meandering course, passing principally through uninhabited territory. Charles Street and Thomas Street are not as yet improved.

At Westropp Street the stream also passes under the roadway through a stone culvert. At this point and on the north side of the street, the stream receives the discharge from a 24-inch combined sewer. This sewer serves a large district to the eastward and has a flow estimated at about 200,000 gallons per 24 hours. The conditions are rendered especially bad at this point, due to the ponding of the water by a construction dam a short distance below which was built for the purpose of diverting the stream during construction of a culvert under the Lake Shore boulevard. This water being practically all sewage, undergoes very active putrefaction and at times gives rise to extremely bad odors very offensive to passersby. As Westropp Street is one of the principal thoroughfares in this part of the village, many persons are subjected to the nuisance.

At the lake shore the sewage spreads out and covers a very large recently constructed concrete culvert. Within this culvert discharge two temporary sewer outlets. One of these, 12 inches in diameter, takes the flow from a 24-inch combined sewer from the eastward, serving a considerable district along the lake front. The other, a 15-inch sewer, takes the discharge of a 3-foot brick sewer in Adams Avenue, which serves a large area to the westward. The ordinary dry weather flow of these sewers probably does not exceed 100,000 gallons per 24 hours. From the temporary dam just above the culvert under the Lake Shore boulevard, the stream has a rapid fall to the lake front. Owing to this, the increased sewage flow within the culvert does not noticeably increase the nuisance.

At the Lake Shore the sewage spreads out and covers a very large area, which sometimes reaches 1000 feet or so to the eastward and gives rise to objectionable odors in the summer park known as the "White City."

The remedy for the conditions above described is very simple and involves only the following extensions and alterations:

(1) The discharge of all sanitary wastes from the Lake Shore and Michigan Southern Railroad round house into an existing sewer lying in Fulton Street.

(2) The continuation of the 24-inch Westropp Street sewer across Rockefeller Creek and its connection with the 3-foot trunk sewer in Adams Avenue.

(3) The extension of the 24-inch brick sewer in the Lake Shore boulevard across Rockefeller Creek and its connection with the 3-foot trunk sewer from Adams Avenue.

(4) The extension of the 3-foot Adams Avenue sewer to the outfall chamber of the Cleveland interceptor. This chamber with its accessories has been designed and constructed expressly with a view to handling the Collinwood sewage.

The above outlined extensions and alterations involve merely the expenditure according to the engineer's estimate of $7,430. This item compared with the total cost of the sewerage system, namely, $313,109, is so small as to give very little excuse for delay.

SUMMARY.

The investigation described in the foregoing report reveals the fact that the village of Collinwood is discharging sewage into Rockefeller Creek unlawfully inasmuch as the outlets used have not received the approval of the State Board of Health, and furthermore the discharge of such sewage creates a foul nuisance which is decidedly detrimental to the comfort of those passing near or residing in the vicinity of Rockefeller Creek.

The village should therefore be required to build such connecting sewers as are necessary to convey the entire sewage flow to the outfall of the Cleveland interceptor, as was the original intention. Also the village should take necessary steps to prevent contamination of the stream in other ways than by the discharge of the village sewage.

ORDER OF THE BOARD.

The following order to the mayor and council of Collinwood was issued December 9th, 1909:

Whereas, The State Board of Health of the State of Ohio having under consideration the conditions existing in and adjacent to the village of Collinwood, Cuyahoga County, Ohio, as set forth in the complaint, in writing, made to the State Board of Health by the health officer of the village of Collinwood, as required by Section 1 of an act of the General Assembly of Ohio entitled, "An act to authorize the state board of health to require the purification of sewage and public water supplies and to protect streams against pollution", passed April 7th, 1908, (99 O. L. p. 74) did, in accordance with the duties imposed upon said Board by said act, pursue all and singular the requirements and duties to be performed by said State Board of Health, and having inquired into and investigated the conditions complained of in said complaint, and

Whereas, The State Board of Health, after investigating the conditions complained of, found that the said village of Collinwood, Cuyahoga County, Ohio, is discharging and permitting to be discharged sewage and other wastes into Rockefeller Creek, otherwise known as Lake Shore Ditch, and by reason thereof has so corrupted said creek as to give rise to foul and noxious odors, thereby creating conditions that are detrimental to the comfort of the citizens of Collinwood, Cuyahoga County, who reside in the vicinity of said creek, or ditch, and

Whereas, Acting pursuant to the requirements of the Act aforesaid, said State Board of Health thereupon on the 8th day of September, 1909, notified such village so causing the contamination or pollution of such stream, of its said findings, and gave said village an opportunity to be heard before said Board on the 13th day of October, 1909, and

Whereas, On the 13th day of October, 1909, no representative from said village of Collinwood having appeared, a letter was presented from the village clerk of said village of Collinwood, stating that the village of Collinwood by act of council on September 30th, 1909, waived its right of a hearing on the date named.

Thereupon, after discussion and due consideration of said complaint the State Board of Health does find and determine that the following improvements or changes in said conditions aforesaid are necessary, and should be made, to-wit: That the village of Collinwood should be required to build such connecting sewers as are necessary to convey the entire sewage flow to the outfall of the Cleveland interceptor and that the village take the necessary steps to prevent contamination of the said Rockefeller Creek in other ways than by the discharge of the village sewage, on or before August 1st, 1910.

Thereupon, on motion duly seconded, the report and findings of said State Board of Health are hereby ordered transmitted to the Governor and Attorney General for their action thereon.

I hereby certify that the foregoing report and findings were duly made by said State Board of Health of the State of Ohio, and that the proceedings above set forth were duly had before said Board, as shown by the minutes thereof.

(Signed) C. O. Probst,
Secretary of State Board of Health
of the State of Ohio.

COLUMBUS, OHIO, December 9th, 1909.

The foregoing report and findings having been examined by us, respectively, the Governor of the State of Ohio, and the Attorney General of the State of Ohio, the same are in all respects approved this 9th day of December, 1909.

(Signed) JUDSON HARMON,
Governor of Ohio.
(Signed) U. G. DENMAN,
Attorney General of Ohio.

REPORT ON INVESTIGATION OF ALLEGED POLLUTION OF THE WATER SUPPLY OF DAYTON BY WASTES FROM THE PLANTS OF THE WUICHET FERTILIZER COMPANY AND THE DAYTON REDUCTION COMPANY.

On August 25, 1909, the following petition under the Bense Act was received from the board of health of the city of Dayton:

"*To the State Board of Health of the State of Ohio.*

GENTLEMEN: The Board of Health of the City of Dayton, State of Ohio, hereby respectfully makes complaint in writing unto the State Board of Health of the State of Ohio in accordance with a resolution duly adopted by the said Board of Health of the city of Dayton, a copy of which is hereto attached and marked 'Exhibit A.'

Complainant says that the city of Dayton, Ohio, derives its water supply from a series of driven wells; that many of said wells are located in the bed of Mad River in the vicinity of the pumping station; that said water supply is one of unusual purity and excellent quality; that said water in the bed of Mad River which is pumped into the pipes of the Holly system at the pumping station at Dayton, Ohio, is rain water which has percolated downwards for a greater or lesser distance through the glacial drift deposits in the Mad River valley, and which flows by gravitation from north to south to the pumping territory, replenishing the same as quick and as fast as the frictional resistance to the flow caused by the sand and gravel will permit.

At a distance of about one mile above the pumping station of the Dayton water works, there is located on the bank of Mad River the plant of The Wuichet Fertilizer Company, a concern which collects the carcasses of dead animals and reduces them for the purpose of producing fertilizer and other products therefrom.

Two pipes discharge waste from the works of said plant into Mad River. In close proximity to said plant there is located the plant of The Dayton Reduction Company, a concern which receives the garbage from the city of Dayton and reduces the same by a process known as the Edison reduction system, producing fertilizer and other products therefrom. A tile pipe discharges waste from said plant into Mad River.

The city bacteriologist has analyzed the water discharged from these pipes and the water above where said discharges are made, and the water at several different points below where said discharges are made. The results of his analyses, examinations, and tests are given in full in his report, a copy of which is hereto attached and marked 'Exhibit B', and to which reference is made.

Reference is also made to the report on additional water supply for the city of Dayton, Ohio, made by Arthur Geisler, consulting engineer, in August, 1908, to the Board of Public Service of the city of Dayton, Ohio, which is submitted herewith, and marked 'Exhibit C'. In this report is a description of the nature of the source of the city water supply, which throws light upon the question of the danger of contamination from the causes herein complained of.

Reference is also made to the report on 'Additional Water Supply and Improvement of the Distribution System for the City of Dayton, Ohio,' made by G. H. Benzenberg, consulting engineer, April, 1909, which is submitted herewith and marked 'Exhibit D'. In this report, on pages 10 and 11, Engineer Benzenberg speaks of the establishments herein complained of and describes them as being very objectionable in connection with any source of water supply.

From the foregoing sources of information the Board of Health of the city of Dayton, Ohio, is of the opinion that the source of water supply of the city of Dayton is being subject to contamination by the discharge of waste into Mad River from the plants of The Wuichet Fertilizer Company and The Dayton Reduction Company.

Wherefore, said Board of Health respectfully requests the State Board of Health to forthwith inquire into and investigate the conditions herein complained of.

Said Board of Health of the city of Dayton, Ohio, makes this request in accordance with the provisions of Section one of an act of the Legislature of Ohio, entitled 'An act to authorize the State Board of Health to require the purification of sewage and public water supplies, and to protect streams against pollution,' passed April 7th, 1908, and recorded in 99th volume of Ohio Laws, page 74.

And Section 8 of an act of the Legislature, entitled 'An act to revise and consolidate the laws relating to the appointment, powers and duties of the State Board of Health,' etc., passed May 9th, 1908, and recorded in 99th volume of Ohio Laws, page 494.

Said Board of Health of the city of Dayton, Ohio, respectfully requests the State Board of Health to take such action for the protection of the water supply of the city of Dayton, Ohio, as the facts in the case and the laws of Ohio may warrant.

(Signed) J. Morton Howell,
President pro tem. of the Board of Health
of the City of Dayton, State of Ohio."

"Attest: (Signed) W. L. Miller,
Clerk of the Board of Health
of the City of Dayton, State of Ohio."

Dated Aug. 24, 1909.

Dr. Byron Stanton, president, Dr. C. O. Probst, secretary, and Mr. Paul Hansen, acting chief engineer, were appointed as a committee of investigation. This committee visited Dayton on September 10, 1909, made an inspection of the conditions complained of, and met in conference with the local board of health and a representative of The Wuichet Fertilizer Company mentioned in the above petition. The following report is submitted:

The public water supply of Dayton has already been discussed in full in a report prepared by the engineering department of the State Board of Health under date of October 29, 1907. It will, therefore, not be necessary to enter into details concerning the source of supply.

Suffice it to say that the water is drawn from a large number of wells sunk in the bed of Mad River near the Keewee Street bridge. These wells range in depth from 40 to 50 feet and derive their supply from extensive gravel deposits lying in the Mad River valley. At a distance of nearly a mile above the wells, there is discharged into Mad River considerable quantities of putrescible wastes from the plant of The Wuichet Fertilizer Company and the garbage plant of The Dayton Reduction Company. The character of these wastes is not exactly known, but presumably the most objectionable are floor washings. The quantity of wastes discharged into the stream is rarely sufficient to cause gross pollution or a public nuisance, though at times the stream is rendered somewhat unsightly thereby.

At about 1,700 feet below the outlet of the drains from the fertilizer and garbage plants is a dam which forms a pool of water. The slow flow caused by the damming up of the stream, serves to effect considerable self-purification of the water so that by the time it reaches a point over the public supply wells there is no visible evidence of contamination, though considerable contamination can be detected by analytical methods.

It is feared by the local health authorities that the wells derive their supply of water largely by infiltration through the bed of the river, and pollution of the river by wastes from the fertilizer and garbage plants would tend to cause a deterioration of the water in the wells. This explanation of contamination of the wells would seem plausible on first thought, but a careful consideration of a long series of analyses made in the laboratories of the State Board of Health and other data collected by that Board does not bear out this theory. It would appear in fact that the bed of Mad River is very completely silted up so as to permit little percolation through the bed of the stream into the underlying waterbearing strata. This silting up of the bed of a stream is not at all unusual and has been observed in a number of other places in the state of Ohio. Also it would appear that there is very little relation between the character of the ground water and that in the river, as revealed by analytical evidence. For example, the chlorine content, which is a most valuable index of past pollution, is invariably much higher in the river water than in the well water. There is a variation in the chlorine content of different wells, but this is suggestive not of river pollution but of pollution from nearby thickly populated areas. These areas were formerly more or less honeycombed with privy vaults and cesspools, but it is stated that they have been sewered in accordance with suggestions made by the State Board of Health. Sewers will undoubtedly greatly improve conditions, but they cannot be counted on to eliminate all danger from contamination.

To further elucidate the fact that there is but little connection between the water in the river and the water derived from the wells, mention may be made of the effect of flooding a number of acres of land known as the Bimm property which lies adjacent to the well series. The water turned on to the Bimm property rapidly raised the ground water level in the vicinity of the wells, and when the water was permitted to drain off through the soil, the ground water level showed a corresponding drop. The fall in the ground water level took place notwithstanding the fact that the river directly over the wells was at high stage when percolation through its bed might be expected to be at a maximum. In other words, the flooding of the Bimm property indicated very clearly that there is no relation between the level of ground water and the condition of the water in Mad River. It may also be added that should a regular practice be made of increasing the flow of the wells by flooding the Bimm property, the soil would soon become clogged and be practically as impervious as the river bed. The perviousness, however, might be reestablished by scraping off the surface soil.

The evidence against the possible contamination of the wells due to wastes discharged into the river from the fertilizer and garbage plants is still further added to by the results of numerous sanitary analyses of the water derived from the wells, which invariably show a water of exceptionally good quality. There has been evidence of pollution of certain of the wells due undoubtedly to nearby privy vaults, and these wells have been duly shut off from the system.

Extensive beds of gravel such as those from which the water is derived constitute the most efficient purifying medium afforded by nature. Analytical methods of water analysis afford a means whereby the influence of contamination can be detected before such contamination becomes really dangerous. In the case of water derived from such extensive gravel deposits as those found at Dayton, it would be possible to detect the influence of contamination many months before the danger point is reached. In point of fact, the State Board of Health is keeping in close touch with the water supply at Dayton and aims to have samples of water representing individual wells and also composites of all the wells analyzed in its laboratories at intervals not greater than one year. Such analyses will enable the State Board of Health to notify the local authorities in ample time should there at any time be indication of a deterioration of the supply which may render the water unwholesome.

CONCLUSIONS.

In conclusion it may be said that while the discharge of wastes from the plants of The Wuichet Fertilizer Company and The Dayton Reduction Company may be objectionable for other reasons, there is not sufficient evidence to warrant the State Board of Health in ordering the above mentioned companies to cease the discharge of such wastes into

Mad River on the ground that the public water supply of Dayton is affected thereby. As it cannot be positively assured that the wells will continuously remain free of contamination from the river it would be advisable to remove the sources of pollution complained of. There would seem to be a way for the amicable adjustment of the matter since Mr William Wuichet, a representative of both offending companies, stated to the committee that if a city sewer were extended to within reach of the plants the companies would be willing to discharge their wastes into same even though this involved pumping.

This report was adopted by the Board at its meeting held October 13th, 1909, and a copy of the report was sent to the board of health of Dayton and to Mr. William Wuichet.

REPORT ON INVESTIGATION OF THE POLLUTION OF THE TUSCARAWAS RIVER AND NUISANCE CAUSED BY EXISTING SEWER OUTLETS AT NEW PHILADELPHIA.

On April 6th, 1909, there was received from the board of health of New Philadelphia, the following petition:

"*State Board of Health, Columbus, O.*

Gentlemen: Whereas, The outlets of the sanitary sewers of our city are so situated that the sewage emptying into the Tuscarawas River at said outlets has caused and continues to cause a corruption and pollution of said river, and gives rise to foul and noxious odors, and produces conditions that are detrimental to the health and comfort of those residing in that part of the city, and the council of the said city has been importuned and petitioned on numerous occasions during the last several years, to remove the outlets of said sewers to a place further down said river to such a distance as to relieve said conditions, and

Whereas, Said council of New Philadelphia, Ohio, has paid no attention to said importunities and petitions, Therefore, we, the undersigned, the board of health of the city of New Philadelphia, Tuscarawas County, Ohio, do hereby petition and entreat your honorable body to take the necessary procedures immediately to compel said city council to remove the said sewer outlets down said Tuscarawas River to such a point as will abate said unsanitary conditions, in accordance with House Bill No. 699 passed April 7th, 1908.

Respectfully submitted,
Attest: (Signed) John M. Schell, *President.*
(Signed) E. B. Shanley, *Clerk.*"

The above petition was accompanied by a second petition reading as follows and signed by R. Q. Harding and some 600 other citizens of New Philadelphia:

> "*State Board of Health, Columbus, Ohio.*
>
> GENTLEMEN: We, citizens of New Philadelphia, Tuscarawas County, Ohio, do hereby entreat your honorable body to grant the petition of our city board of health and compel our city council to move the present outlets of sewers further down the river."

The president appointed Mr. Hartzell, member, and the chief engineer, a committee to investigate the complaint. This committee visited New Philadelphia on April 15th, 1909, met the local officials, and inspected conditions. The following report was then made:

In 1893, a few months after the passage of the law making it necessary that the State Board of Health approve new sewer outlets, a large combined sewer was constructed in New Philadelphia with outlet into the Tuscarawas River at the foot of First Street. This sewer has from year to year received more and more domestic sewage, until at the present time it is the principal sewer of the city. The sewage is discharged some 8 or 10 feet above the low water level and spreads out over the river bank. The outlet has been the source of much complaint during the past several years.

In March, 1907, the assistant engineer, at the request of a number of citizens, inspected conditions and found the complaints justified. Following his report, the city was advised to have prepared plans for a system of sanitary sewers with purification works.

In October, 1907, upon the authorization of the New Philadelphia council, there were prepared and submitted to the Board by Mr. Paul R. Murray of New Philadelphia, and Mr. E. G. Bradbury of Columbus, plans and specifications for a complete sewerage system and sewage purification works. These were approved with the following conditions:

> "1st. That the sewage purification works be built before any of the new sewers are placed in use.
>
> 2nd. That the operation and management of the plant be at all times satisfactory to the State Board of Health."

At the meeting of the State Board of Health in January, 1908, a committee of citizens appeared before the Board. This committee, as a whole, requested that the present outlet into the Tuscarawas River at the foot of First Street, constructed in 1903, be approved. One member of the committee, however, submitted an individual request that in case of disapproval of the existing outlet, the city be allowed to construct new sewers and discharge the sewage from same into the river through a new outlet without sewage purification. This matter was referred to a committee consisting of the chief engineer, who visited New Philadelphia, conferred with the local officials, and inspected the conditions. Based on his report, the following action was taken by the Board at its April, 1908, meeting:

"(1) The present sewer outlet into the Tuscarawas River near the foot of First Street, plans for which were never submitted to the State Board of Health for approval as required by law, and which outlet is now the cause of offensive conditions in the river, is disapproved; and,

(2) Permission to construct the proposed main sewer and to omit the purification works is refused; but the city is permitted to construct the main sewer and sewage purification works as approved, omitting the eight southerly filters for the present, provided, however, that additional filters be constructed and placed in use as and whenever deemed necessary by the State Board of Health."

The authorities were also notified that permission to amend the plans in this way did not in any other particular change the action of the Board on the proposed plans, as set forth in its letter of approval of November 6th, 1907, to the authorities.

At the time of the recent inspection the committee found that the sewer was still causing a nuisance even though the river was high. Odors could be detected several hundred feet from the outlet. The stream was also being polluted by a 20-inch sewer discharging a short distance above the main sewer. It is believed, therefore, that the complaints of the 600 citizens and the local board of health are amply justified.

As regards the financial condition of the city, the following information was obtained from the city solicitor and the mayor:

Total tax duplicate	$2,460,000
Total bonded indebtedness to date............	59,000
Money appropriated during present year which would be taken account of under Longworth Act............	none.

From the above it will be seen that the bonded indebtedness of the city is only 2.4 per cent, which is well under the 8 per cent allowed by the Longworth Act. Revised estimates of the cost of constructing the sewage purification plant according to the amended plans above mentioned, amounted to less than $20,000, or 0.7 of one per cent of the total valuation. The cost of extending the main sewer from First Street to the purification site would be $10,000 or $15,000. It will be seen, therefore, that the city finances even without authority under the Bense Act would permit appropriating enough money to remedy conditions, although a portion of such would have to be authorized by a vote of the people if spent within the present year.

The main sewer outlet at New Philadelphia discharging into the Tuscarawas River at the foot of First Street and also a 20-inch sewer discharging a short distance above First Street, cause conditions detrimental to the health and comfort of the people living near said outlets. It is important that the main sewer be extended to the site already approved for a sewage purification plant and that such plant, which will not exceed $20,000 in cost, be installed as soon as possible.

The authorities of New Philadelphia were advised of the Board's findings, and at a meeting held June 16th, 1909, in answer to a citation to meet the Board and show cause, if any, why the city of New Philadelphia should not be required to install purification works to abate the nuisance complained of, the city solicitor appeared before the Board and contended that the complaint made by the board of health was in effect a resolution and not a complaint. He filed a resolution passed by the board of health on June 2nd, 1909, requesting the Board to dismiss the former resolution from further consideration.

The solicitor also asked the Board to modify its former conditions of approval of additional sewers and sewage disposal plant, such modification to be a requirement that but four filter beds be constructed in the first operation of the plant, additional filters to be added as required. He further asked the Board to not require the building of the sewage disposal plant for a period of three or four years after the proposed changes and additions to the sewerage system.

At this meeting, June 16th, 1909, the Board voted to postpone further proceedings against New Philadelphia under the Bense Act, provided, (a) that the present sewer with an outlet into the Tuscarawas River near the foot of First Street be abandoned for house drainage or sewage; and (b) that the city proceed without further delay to install the system of sewers and sewage purification in accordance with plans submitted to the Board by Mr. Paul R. Murray of New Philadelphia and Mr. E. G. Bradbury of Columbus, with permission, however, to construct in the beginning but four of the filter beds provided for the sewage disposal plant, and that such additional filters shall be constructed and placed in use as and whenever deemed necessary by the State Board of Health.

REPORT ON INVESTIGATION OF THE POLLUTION OF THE WATER SUPPLY OF NILES.

In connection with the Mahoning River investigation, considerable data have been obtained with reference to the quality of the water supply at Niles, and to the prevalence of typhoid fever in the city. Supported by considerable concisive analytical data, present evidence seems sufficiently important to warrant some action regarding the use of a polluted water supply. The present situation explained in the following report is supplemented by a few facts regarding the Niles water supply and the character of the water furnished to the consumers.

BRIEF DESCRIPTION OF NILES WATER WORKS.

The city of Niles, Trumbull County lies on the Mahoning River about ten miles above Youngstown and about five miles below Warren. The present population is about 10,000. Niles is an extensive manufacturing center engaged chiefly in the manufacture of steel and iron products. A considerable portion of the area within the corporate limits is sewered and there are several miles of paved streets.

The water works owned by the city and operated in conjunction with a municipal electric light plant were installed in 1891. They comprise a system of driven wells, one large well which serves also as a receiving well, pumping machinery, air compressor, distribution system and an equalizing reservoir. For emergency use an intake is provided in the Mahoning River. The supply is derived from 11 wells driven from 45 to 65 feet to a water bearing gravel, and located on several acres of land adjoining the Mahoning River and about 1,000 feet south of Main Street. The wells range range in size from 5⅝ to 10 inches. The supply thus secured is supplemented by that from a large receiving well with porous bottom which is 17 feet in diameter and 70 feet deep.

Water is raised from the small wells by Harris air lifts and is discharged into the large well just mentioned. From this well it is forced by the pumps into the mains and to the reservoir. The pumping plant comprises two compound duplex pumps, with 10-inch barrel and 18-inch stroke. The suction of the pump is in the large well as before stated and the ordinary suction lift is at times fully 25 feet. For emergency use in case the supply from the wells proves inadequate or when the air compressor is out of service, there is a 14-inch intake through which water may be pumped directly from the Mahoning River.

The pumping station houses, besides the pumps, an Ingersol air compressor belt driven from a motor, equipment for lighting the city, and two boilers with a feed water pump and other accessories. The pumps force the water directly into the mains or to a reservoir which serves as an equalizer. This is a covered brick tank 70 feet in diameter and 16 feet deep with a capacity of about 500,000 gallons. The water enters the reservoir at the bottom, is drawn off through the same pipe so that unless the pumpage exceeds the consumption no water enters the reservoir.

The Niles water supply including the wells and the emergency intake into the Mahoning River were never submitted to the State Board of Health for approval.

TYPHOID FEVER EPIDEMIC OF DECEMBER, 1901, TO MARCH, 1902.

From the report of the Board for 1902 (page 194), it appears that in the winter of 1901-1902 there occurred at Niles an outbreak of typhoid fever of some severity. This was investigated by Dr. Horton, chemist of the Board who concluded that the epidemic was due partly to the polluted character of the Niles water supply and partly to the contaminated milk supply.

It was found that of the 107 cases, 93 used the hydrant water. It was developed that in the late fall of 1901 there had occurred at Warren several cases of typhoid fever and it was further learned that on several occasions the raw river water had been pumped into the Niles mains. It was found, moreover, that the heaviest outbreak of cases occurred from March 1 to 5, 1902, from 10 to 14 days after the river water was pumped into the mains during a fire. Analyses indicated that the water of the Mahoning River opposite the Niles water works was grossly polluted by the Warren sewage*. Samples of the hydrant water showed, however, no excessive bacterial contamination nor did the water collected directly from the wells. The evidence showed that a large part of the typhoid fever cases were to be attributed to the pumpage of raw Mahoning River water into the city mains. Apparently nothing was done at this time to prevent the use of the emergency intake into the Mahoning River, nor to obviate the necessity for supplementing the supply from the wells by water from the Mahoning River.

PRESENT TYPHOID CONDITIONS.

Inquires made in Niles on February 15, 1909. disclosed the fact that no records whatever are kept by the local health authorities regarding typhoid fever cases as are required by the Ohio laws (R. S. Sec. 2125.) On this account no accurate information could be obtained regarding the present number of typhoid fever cases in Niles. It is rumored, however, that there have recently been from 20 to 25 cases of fever, some of which may possibly be typhoid and it is known that four typical cases have been sent to the Warren hospital for treatement. The health officer of Niles, Dr. H. F. Brown, considers the majority of the cases to be non-typical but has made no tests and bases his opinions only upon the regular medical diagnosis. The health officials of Niles are very lax in the matter of reporting contagious diseases, especially typhoid fever and it would be advisable to call their attention to the legal phase of the matter with a view to obtaining full health records from Niles in the future.

CHARACTER OF PRESENT WATER SUPPLY OF NILES.

Field work incidental to the Mahoning River investigation has included analyses of samples from the Mahoning River above Niles and also of samples of the Niles water supply. On the third survey which was carried out at Niles and vicinity from February 11-17, 1909, in view of the reported typhoid fever outbreak it was thought advisable to obtain as much analytical evidence as possible relative to the character of the water pumped into the Niles mains. This feature was deemed of special importance since previous developments at Niles and the use of raw river water would point to a polluted water supply as the probable cause of the typhoid fever epidemic.

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* Report of State Board of Health, 1902, p. 205.

On February 12, 1909, samples were collected from the Mahoning River above the Niles water works intake and from a tap in the Allison Hotel, Niles. On February 15, and 16, 1909, four samples were collected from the Mahoning River above Niles and five samples from the mains at several points in the city.

To understand the full significance of the results of the analyses of these samples it is necessary to mention a few features of the operation of the Niles water works, especially conditions which prevailed on February 15, 1909. It appears that on nights when there is no moon, that is when the arc lights are lighted, there is insufficient equipment to operate the air compressor and hence no water is raised from the small wells by the air lifts. This condition generally prevails from perhaps 6 to 11 o'clock P. M. The supply during these hours is drawn from the large well to a maximum suction lift of about 25 feet and if the water does not flow into the large well in sufficient volume it is then necessary to draw on the river. Were the reservoir full there would be sufficient water available to tide over the period during which the air compressor is stopped but it appears that there is generally little water in the reservoir due either to a lack of sufficient water in the wells, insufficient steam power, or insufficient electrical power. In any event the reservoir can not be depended upon to furnish a supply while the electric lights are being used. Briefly stated, evidence is strong that because of mechanical difficulties and probably lack of well water, raw Mahoning River water is admitted into the Niles water mains for about 5 hours each night, when the electrical equipment at the municipal light station is in full operation (commercial, domestic and street lighting.)

The result of this pumpage of raw river water for a few hours on dark nights is a contamination of the Niles public water supply. Moreover this contamination persists for a considerable period after the raw river water is shut off as is indicated by analytical evidence obtained during the Mahoning River investigation. The analytical data obtained on three surveys made from July, 1908, to February, 1909, are shown in a table below. These are analyses of the Mahoning River above Niles at the emergency intake of the Niles water works and samples of the Niles supply collected at several points in the city. Referring to these data it will be observed that the Mahoning River water is grossly polluted by the sewage of Warren at all times. It will be observed also that on each of the three surveys the Niles supply has been found to be polluted as indicated by the presence of B. coli. On the first survey in July, 1908, the water from the mains contained 9 bacteria per c. c. with coli present in 3 c. c. In October, 1908, apparently raw river water had been pumped on the previous night as the water from the mains contained 8,500 bacteria per c. c. with B. coli present to the extent of at least 20 per c. c. Again in the morning of February 12, 1909, the water from the mains contained few bacteria but there was evidence of its past pollution as was indicated by the presence of B. coli.

The most interesting results were obtained on February 15, 1909. In the afternoon a sample collected from the pumps contained 25 bacteria and a sample from three of the wells, 9 bacteria per c. c. Similarly, a sample collected near the Erie Railroad station at McGurk's hotel, contained 68 bacteria and was chiefly well water as indicated by its turbidity. Beginning at about 6 o'clock P. M. and continuing until about 11 o'clock P. M. the water from the large well was supplemented by that from the river. The river was in a normal flood stage and as the analyses indicate contained large numbers of bacteria and was of high turbidity. Samples collected at the force main near the pumps at 9:50 o'clock P. M. February 15, showed 69,000 bacteria per c. c. with coli present in 0.1 but absent in 0.01 c. c. The turbidity of this water was 230 and its alkalinity 60, while the turbidity of the well water was about 15 and its alkalinity about 190 parts per million. These results indicate that at the time this sample was collected, about 75 per cent of the water pumped into the Niles mains was from the Mahoning River.

The gross pollution of the water supply of Niles by this practice of an almost daily use of the emergency intake in the Mahoning River is clearly shown by a study of the following analytical data.

Chemical and Bacterial Analyses of the Mahoning River Above Niles and of Samples of the Niles Water Supply.

Field No.	Collected. Date	Collected. Hour.	Source.	Temperature F.	Bacteria per c.c.	Colon in				Parts per Million Color.	Turbidity.	Alkalinity.	CO_2	Diss. Oxy.
						.001	.002	.005	0.5					
N 70	July 23, '08..	3:15 P. M.	Mahoning River above Niles at water works...........	75	310,000	+	-	+	+	25	55	70	3	5.7
						.001	.005	.03	0.5					
71	July 23, '08..	9:30 P. M.	Mahoning River above Niles at water works...........	74	85,000	0	+	+	+	25	50	102	6	5.8
72	July 24, '08..	7:30 A. M.	Mahoning River above Niles at water works...........	74	280,000	0	+	+	+	25	90	82	4	5.7
73	July 24, '08..	3:00 P. M.	Mahoning River above Niles at water works...........	74	1,900,000	0	0	+	+	30	100	76	3	3.6
						3	50							
74	July 24, '08..	3:00 P. M.	Niles water supply tap at Allison Hotel..................	61	9	+	+	......	......	10	10±	186	2	11.3
						.001	.005	.025						
N 71	Oct. 5, '08....	3:30 P. M.	Mahoning River above Niles at water works...........	61	200,000	+	+	+	......	15	18	162	2	9.0
72	Oct. 5, '08....	9:30 P. M.	Mahoning River above Niles at water works...........	57	71,000	0	0	0	......	15	18	161	2	9.4
73	Oct. 6, '08....	7:00 A. M.	Mahoning River above Niles at water works...........	55	36,000	0	0	+	......	15	18	156	3	8.6
74	Oct. 6, '08....	2:00 P. M.	Mahoning River above Niles at water works...........	61	110,000	0	+	-	......	15	18	150	4	10.0
						.05	.2	.1						
87	Oct. 6, '08....	11:00 A. M.	Niles water supply tap at Allison Hotel..................	66	8,500	-	+	-	......	3	5±	180	4	11.0
						.05	.1	.3	1.0					
N 52	Feb. 12, '09...	8:50 A. M.	Mahoning River above Niles at water works...........	34	8,000	-	+	+	+	......	100	30	1	14.0
						.5	1.0	3.0						
N 53	Feb. 12, '09...	9:15 A. M.	Niles water supply tap at Allison Hotel..................	49	150	+	+	-	......	......	15	182	4	12.4
						.01	.1	.5	1.0					
N 60	Feb. 15, '09...	10:35 A. M.	Mahoning River above Niles at water works...........	37	60,000	......	......	......	......	......	150	24	4	13.2
61	Feb. 15, '09...	3:50 P. M.	Mahoning River above Niles at water works...........	36	47,000	......	......	......	......	......	220	19	3	13.6
62	Feb. 15, '09...	10:55 P. M.	Mahoning River above Niles at water works...........	36	180,000	0	+	-	......	......	350	15	4	12.8
63	Feb. 16, '09...	9:45 A. M.	Mahoning River above Niles at water works...........	35	33,000	0			+	......	230	13	3	13.6
N 75	Feb. 15, '09...	3:30 P. M.	Niles water supply tap force main near pumps..........	50	25	......	......	......	......	......	12±	183	6	10.4
N 76	Feb. 15, '09...	3:10 P. M.	Wells Nos. 2, 3, 4..	53	9	......	......	......	......	......	0±	201	7	12.0
N 77	Feb. 15, '09...	3:30 P. M.	Niles water supply tap at McGurk Hotel..................	46	68	......	......	......	......	......	5±	178	7	10.8
						.01	.1	.5						
N 78	Feb. 15, '09...	9:50 P. M.	Niles water supply tap force main near pump...........	41	69,000	0	+	+	......	......	230	60	3	12.8
N 79	Feb. 15, '09...	10:25 P. M.	Niles water supply tap Allison Hotel......................	......	39,000	0	-	+	......	......	160	69	3	11.6

Began to pump river water, Feb. 15, 1909 about 6:00 P. M. Stopped 10:57 P. M.

CONFERENCE WITH BOARD OF PUBLIC SERVICE.

On Tuesday evening, February 16, 1909, two of the assistant engineers had an informal talk with the board of public service of Niles, the superintendent of water works and the city engineer. It was stated that on all of the visits to Niles since July, 1908, analytical evidence had shown that the Niles water supply was polluted to such an extent as to be unfit for domestic purposes without boiling. It was pointed out that the well water itself appeared to be safe and entirely satisfactory from a sanitary point of view. In discussing the pollution of the supply and the use of the raw Mahoning River water the situation at Niles was found to be about as follows:

At the present time water is raised from the small wells by the Harris air lifts and falls some 20 feet into the large well which acts as a receiving well and which contains the suction of the pumps. When it is necessary to operate all the electrical equipment there is insufficient power to drive the air compressor and since the large 17-foot well can not furnish sufficient water it is necessary to turn on the raver. For some reason, probably insufficient well capacity, it is impossible to fill the reservoir during the day time, so that the water there stored may be available for use during the evening hours when the air compressor is out of service. It is further true that the water from the wells is lifted twice, thereby materially increasing the cost of pumping. It was stated that during the very dry season last fall there was plenty of well water, but there appears to be some question as to whether or not this is true.

It was explained to the board that the practice of pumping the raw river water is exceedingly dangerous and that the citizens of Niles should be warned at once to boil the water until further notice. It was suggested that an effort be made to provide such additions or repairs to the pumping plant as would obviate the use of river water. The attention of the board was also called to the fact that considerable laxity exists in the matter of reporting typhoid fever cases.

The board appeared to be in favor of making the necessary changes and improvements at the water plant, but to do so requires the co-operation of the city council. On the following day, through the newspapers, the board issued a statement warning the people of Niles not to drink the city water without boiling the same.

CONCLUSIONS.

The water supply of the city of Niles is polluted due to the practice of supplementing the driven well supply with water directly from the Mahoning River. The necessity for using the emergency intake arises because of lack of steam power, electrical equipment and probably well capacity. An outbreak of typhoid fever occurred in 1901-1902 and was shown to be due to the use of polluted Mahoning River water. At the present time some typhoid fever exists in Niles, but owing to the laxity of the health authorities the cases are not reported and very little information is available regarding the matter.

The board of public service was informally advised of the polluted character of the city supply and expressed its willingness to take steps to improve present conditions by making changes, improvements and enlargements necessary to provide continually an ample supply of ground water. Analytical data indicate that the ground water itself is of excellent quality from a sanitary standpoint. While there has been considerable effort in the past to obtain money for improving the water supply, yet the city council has been unwilling to appropriate the necessary funds. It is quite significant that present water supply conditions at Niles have persisted practically ever since the plant was installed in 1891 and possibly it is the absence of typhoid fever in Warren that has prevented the occurrence of typhoid fever in Niles to a greater extent than has been the case.

On July 31st, 1909, the following petition was received from the board of health of Niles:

"To the State Board of Health.

"I, the undersigned, clerk of the Board of Health of Niles, Trumbull County, Ohio, do hereby certify that the board of health of said city, being in session on the 19th day of July, 1909, adopted a resolution of which the following is a true copy:

"Be it resolved by the Board of Health of the City of Niles, Trumbull County, Ohio, That it does hereby make complaint to the Ohio State Board of Health that in its opinion the public water supply of Niles, located in Trumbull County, Ohio, is inadequate to meet the demands and that at times, in case of large fires, it is necessary to pump water into the mains from the Mahoning River, thereby making the water in the mains impure and dangerous to the health of the consumers of said supply; that the State Board of Health is hereby respectfully requested to investigate said water supply of said city of Niles, Trumbull County, Ohio, and if it is found practicable to require the said city to secure an additional source of water supply, by the construction of a new or additional wells, and to require the installation of water meters to prevent the waste of pure water, in accordance with "An act to authorize the state board of health to require the purification of sewage and public water supplies and to protect streams against pollution," passed April 7th, 1908.

(Signed) B. S. HOGAN, *Clerk."*

Niles, Ohio, July 19, 1909.

A committee consisting of Mr. Josiah Hartzell, member of the Board, and A. Elliott Kimberly, assistant engineer, was appointed July 29th, 1909, to investigate the conditions complained of. The committee visited Niles on August 2nd, and as a result of this visit and on the strength of evidence previously secured, submitted the following report:

The water works of Niles, constructed in 1891, comprise a system of driven wells, a large dug well, a pumping plant, air compressor, equalizing reservoir and distribution system. Some years ago there was constructed a fourteen (14) inch emergency intake into the Mahoning River. The average daily water consumption is about 400,000 gallons. The services are not metered.

Under ordinary conditions the well supply is adequate. During fires, however, and at times during cold weather, it is necessary to pump water from the river. At times intestinal diseases have been quite prevalent in Niles.

Analyses of the well water show it to be of excellent bacterial quality. During the investigation of the Mahoning River, analyses of samples of water collected from the mains in the city of Niles showed the presence of sewage bacteria, due to pumping river water to supplement the well supply. The evidence indicated also that this pollution persisted in the mains for some days after the pumping of river water had ceased. It is apparent that the Mahoning River water above Niles is very grossly polluted by sewage of Warren and is absolutely unfit for domestic use without purification.

The committee finds that under present conditions, there is hardly sufficient water available at Niles to meet ordinary demands and that during fires and in cold weather when large quantities of water are wasted, it is necessary to supplement the supply with raw Mahoning River water. This practice contaminates the supply and is thus a distinct menace to the health of the citizens of Niles. At times typhoid fever and intestinal diseases have been quite prevalent in Niles. In general the committee finds that the facts in reference to the water supply of Niles substantiate conditions set forth in the petition from the Niles board of health.

To improve the present conditions at Niles there should be provided a larger supply of water of satisfactory quality. Subsequently arrangements should be made so that the emergency intake cannot be used except under extraordinary conditions and then only with the sanction of the local board of health.

ORDER OF THE BOARD.

The following order to the Mayor and Council and the Board of Public Service of Niles was issued December 9th, 1909:

WHEREAS, The State Board of Health of the State of Ohio having under consideration the conditions existing in and adjacent to the city of Niles, Trumbull County, Ohio, as set forth in the complaint, in writing, made to said State Board of Health by the board of health of the city of Niles, as required by Section 2 of an act of the General Assembly of Ohio entitled, "An act to authorize the state board of health to require the purification of sewage and public water supplies and to protect streams against pollution," passed April 7th, 1908, (99 O. L., p. 74) did, in accordance with the duties imposed upon said Board by said act, pursue all and singular the requirements and duties to be performed by said State Board of Health, and having inquired into and investigated the conditions complained of in said complaint, and

WHEREAS, The State Board of Health, after investigating the conditions complained of, found that the present water supply of the city of Niles is hardly sufficient to meet ordinary demands, and that during fires and cold weather when large quantities of water are wasted it is necessary to supplement the supply with raw water from the Mahoning River, which at this point is highly polluted, thus contaminating at such times the entire water supply of the city of Niles, which constitutes a distinct menace to the health of the citizens of said city, and

WHEREAS, Acting pursuant to the requirements of the Act aforesaid, said State Board of Health thereupon on the 8th day of September, 1909, notified such city so causing the contamination of its water supply, of its said findings, and gave said city an opportunity to be heard before said Board on the 13th day of October, 1909, and

WHEREAS, On the 13th day of October, 1909, pursuant to said notice there appeared before the State Board of Health Mr. Joe Smith, city solicitor, representing said city, and the matters as contained in said complaint were discussed with the said Board, and

Thereupon, after such hearing, the State Board of Health does find and determine that the following improvements or changes in said conditions aforesaid are necessary, and should be made, to-wit: That the city of Niles should be required, on or before October 13th, 1910, to provide a larger supply of water of satisfactory quality, and to make subsequent arrangements so that the emergency intake cannot be used except under extraordinary conditions and then only with the sanction of the local board of health.

Thereupon, on motion duly seconded, the report and findings of said State Board of Health are hereby ordered transmitted to the Governor and Attorney General for their action thereon.

I hereby certify that the foregoing report and findings were duly made by said State Board of Health of the State of Ohio, and that the proceedings above set forth were duly had before said Board, as shown by the minutes thereof.

(Signed) C. O. PROBST,
Secretary of State Board of Health
of the State of Ohio.

COLUMBUS, OHIO, December 9th, 1909.

The foregoing report and findings having been examined by us, respectively, the Governor of the State of Ohio, and the Attorney General of the State of Ohio, the same are in all respects approved this 9th day of December, 1909.

(Signed) JUDSON HARMON,
Governor of Ohio.
(Signed) U. G. DENMAN,
Attorney General of Ohio.

REPORT ON INVESTIGATION OF ALLEGED POLLUTION OF THE MAHONING RIVER AND OF MOSQUITO CREEK BY THE SEWAGE OF NILES.

July 29th, 1909, the following petition was received from the council of the city of Niles:

To the State Board of Health.

I, the undersigned, clerk of the council of the city of Niles, Trumbull County, State of Ohio, do hereby certify that the council of said city, being in session on the 17th day of July, 1909, adopted a resolution of which the following is a true copy, and which has been approved by the mayor of said city:

> "A resolution making complaint to the State Board of Health that the city of Niles is emptying sewage and other waste into the Mahoning River.
>
> "SECTION 1. *Be it resolved by the council of the city of Niles, State of Ohio,* That the city of Niles, located in Trumbull County, Ohio, is discharging and permitting to be discharged, sewage and other waste into the Mahoning River, and has been desirous of discharging other sewage into said Mahoning River and has been prevented by the State Board of Health, and that the sewage and other waste discharged into said river has so corrupted said river as to give rise to foul and noxious odors, thereby creating conditions that are detrimental to the health and comfort of the citizens of Niles, Trumbull County, Ohio, who reside in the vicinity of said river.
>
> "SECTION 2. The State Board of Health is hereby respectfully requested to investigate the conditions complained of, and to require the said city of Niles to install such works or means for purifying or otherwise disposing of its sewage and other wastes as may be determined by said board, in accordance with 'An Act to authorize the state board of health to require the purification of sewage and public water supplies and to protect streams against pollution,' passed April 7th, 1908.
>
> (Signed) B. S. HOGAN, *Clerk.*"
>
> Niles, Ohio, July 17th, 1909.

The president of the Board appointed Mr. Josiah Hartzell, member, and Mr. A. Elliott Kimberly, assistant engineer, a committee to investigate this complaint and report.

The committee visited Niles on August 2nd, 1909, and the following report was submitted:

The committee examined the condition of the Mahoning River below both of the sewer outlets of Niles that discharge directly into the river and at and below the mouth of Mosquito Creek into which there discharge five other sewers. At no point along the river was there noted a marked nuisance such as would be considered a public nuisance and such as would correspond to conditions set forth in the above petition.

The committee does not consider the pollution of the Mahoning River at Niles to be sufficiently intense to warrant action by the Board for the compulsory disposal of the sewage of Niles under the section of the Bense Act cited in the above petition.

SUPPLEMENTARY REPORT.

Supplementing the report of the committee the following report was made by the assistant engineer:

The city of Niles has a population of about 8,000, and lies on both sides of the Mahoning River. It is largely engaged in the manufacture of steel and iron products. It has a water supply derived from a number of driven wells. At the present time there exist 4.97 miles of sanitary sewers and one mile of storm sewers. It is estimated that there are about 2,000 persons connected with the sewers for sanitary purposes.

Niles has seven sewer outlets, two of which discharge directly into the Mahoning River at Chestnut Street and Main Street, respectively, and five which discharge into Mosquito Creek in all cases but one below the point where this creek is dammed within the city of Niles.

At the point of discharge of the Vienna Avenue storm sewer and the Robbins Avenue combined sewer near and under the Robbins Avenue bridge, respectively, there exists a marked and serious public nuisance. Very little water flows in Mosquito Creek during dry weather, that is below the dam, and, as was the case on the evening of August 2nd, the sewage discharged from the above mentioned sewers creates very foul, black, putrid pools from which there emanates a very decided odor, which was noticeable on the bridge. These conditions continue in Mosquito Creek along side of the Carnegie Works. Here the creek bed is practically a septic pool.

A short distance below this point on the creek there enters the Church and Park Avenue sanitary sewer which discharges into a shallow ditch whence, after a distance of about 500 feet, it flows directly into Mosquito Creek. Conditions at and below this point on the creek are very foul. This polluted condition of the creek continues until there is reached the back-water from the river.

Although the present pollution of the Mahoning River by the sewage does not along the river bank produce a public nuisance sufficient to warrant the Board's taking action under the Bense Act, investigation has developed that the absence of suitable means for the disposal of the Niles sewage creates a marked public nuisance in Mosquito Creek within the corporation limits of the city of Niles. It is believed that a petition under the Bense Act referring to the pollution of Mosquito Creek and the public nuisance therein caused would enable the Board to take action under this Act in compelling the city of Niles to provide means for the disposal of its sewage.

The city officials are very anxious to construct additional sewers, particularly on the south side of the river. Recently the Board disapproved an outlet from this district into the Mahoning River and stated that no more sanitary sewers should be built until the sewage could be disposed of in a proper manner. The officials state that they have reached their borrowing capacity under the Longworth Act without an appeal to the people. Owing to local sentiment with reference to all sorts of public improvements growing out of the feeling that has arisen as a result of the wet and dry election, the city officials feel that a bond issue for sewage disposal would be overwhelmingly defeated.

A signed statement from the city auditor shows that the present bonded indebtedness of the city of Niles is $128,000.00, the assessed valuation is $2,398,569.00.

The mayor and council of Niles were informed of the Board's findings, and the following amended petition in regard to the pollution of Mosquito Creek was received September 23rd, 1909:

"A RESOLUTION.

"A resolution making complaint to the State Board of Health that the city of Niles is emptying sewage and other wastes into Mosquito Creek.

"SECTION 1. *Be it resolved by the council of the city of Niles, State of Ohio,* That the city of Niles, located in Trumbull County, Ohio, is discharging and permitting to be discharged, sewage and other waste into Mosquito Creek, and that the sewage and other waste discharged into the said creek has so corrupted said creek as to give rise to foul and noxious odors, thereby creating conditions that are detrimental to the health and comfort of the citizens of Niles, Trumbull County, Ohio, who reside in the vicinity of said creek.

"SECTION 2. The State Board of Health is hereby respectfully requested to investigate the conditions complained of, and to require the said city of Niles to install such works or means for purifying or otherwise disposing of its sewage and other wastes as may be determined by said Board, in accordance with 'An Act to authorize the State Board of Health to require the purification of sewage and public water supplies and to protect streams against pollution', passed April 7, 1908.

"Passed in council this 18th day of September, 1909.

(Signed) J. E. THOMAS,
President of Council.

ATTEST: (Signed) B. S. HOGAN,
Clerk

"Approved by me this 20th day of September, 1909.

(Signed) JOHN S. NAYLOR,
Mayor of the city of Niles, Ohio."

ORDER OF THE BOARD.

The following order to the Mayor and Council and the Board of Public Service of Niles, was issued December 9th, 1909:

WHEREAS, The State Board of Health of the State of Ohio having under consideration the conditions existing in and adjacent to the city of Niles, Trumbull County, Ohio, as set forth in the complaint, in writing, made to said State Board of Health by council of the city of Niles, Trumbull County, as required by Section 1 of an act of the General Assembly of Ohio entitled, "An act to authorize the state board of health to require the purification of sewage and public water supplies and to protect streams against pollution," passed April 7th, 1908, (99 O. L., p. 74) did, in accordance with the duties imposed upon said Board by said act, pursue all and singular the requirements and duties to be performed by said State Board of Health, and having inquired into and investigated the conditions complained of in said complaint, and

WHEREAS, The State Board of Health, after investigating the conditions complained of, found that the said city of Niles, Trumbull County, Ohio, is discharging and permitting to be discharged sewage and other wastes into Mosquito Creek, and by reason thereof has so corrupted said creek as to give rise to foul and noxious odors, thereby creating conditions that are detrimental to the comfort of the citizens of Niles who reside in the vicinity of said creek, and

WHEREAS, Acting pursuant to the requirements of the Act aforesaid, said State Board of Health thereupon on the 8th day of September, 1909, notified such city so causing the contamination or pollution of such stream, of its said findings, and gave said city an opportunity to be heard before said Board on the 13th day of October, 1909, and

WHEREAS, On the 13th day of October, 1909, pursuant to said notice there appeared before the State Board of Health Mr. Joe Smith, city solicitor, representing said city, and the matters as contained in said complaint were discussed with the said Board, and

Thereupon, after such hearing the State Board of Health does find and determine that the following improvements and changes in said conditions aforesaid are necessary, and should be made, to-wit: That the city of Niles should be required to purify its sewage in a manner satisfactory to the State Board of Health on or before October 13th, 1910.

Thereupon, on motion duly seconded, the report and findings of the said State Board of Health are hereby ordered transmitted to the Governor and Attorney General for their action thereon.

I hereby certify that the foregoing report and findings were duly made by said State Board of Health of the State of Ohio, and that the proceedings above set forth were duly had before said Board, as shown by the minutes thereof.

(Signed) C. O. PROBST,
Secretary of State Board of Health
of the State of Ohio.

COLUMBUS, OHIO, December 9th, 1909.

The foregoing report and findings having been examined by us, respectively, the Governor of the State of Ohio, and the Attorney General of the State of Ohio, the same are in all respects approved this 9th day of December, 1909.

(Signed) JUDSON HARMON,
Governor of Ohio.
(Signed) U. G. DENMAN,
Attorney General of Ohio.

MISCELLANEOUS REPORTS

REPORT ON AN INVESTIGATION OF THE MAHONING RIVER.

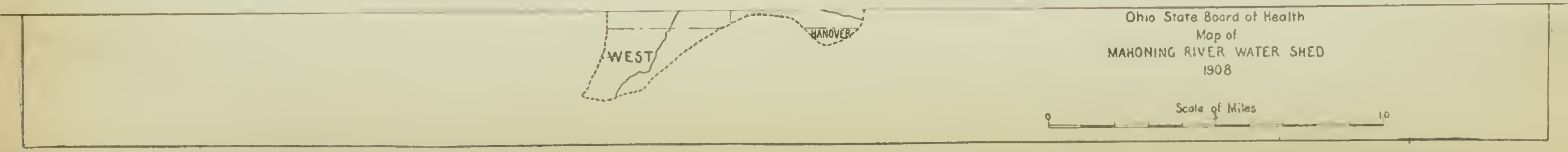
The natural constant increase in population, particularly of inland states, causes the problem of river pollution to become yearly more and more difficult of solution and of increasing importance. While natural water sources are apparently the legitimate drainage basins for man in all his activities they can, of course, receive but a limited quantity of the wastes from a community without causing a serious pollution of the stream. While these limits vary widely under different conditions, the end result is established with some degree of definiteness, for the overpolluted stream soon reflects upon the health of man in the important questions of a public water supply or of a public nuisance. In many instances local conditions are such that communities must turn to the nearest water course for their supply of drinking water and, to their interests, the purity of a stream must be preserved at all costs. As desirous as is the water supply community of obtaining a potable water so desirous is the community above of using the same river for disposal of its liquid wastes. These two problems—water supply and sewage disposal—so intimately correlated, stand out prominently in the field of sanitary science as developed by the state in exercising sanitary control over the health and welfare of her people.

The Ohio State Board of Health was first formulated largely as the protector of the numerous public water supplies in the state, and consequently the Board has given special attention both to the quality of public water supplies and to the general pollution of streams which may be used as their sources. In 1893 the state legislature enacted that:

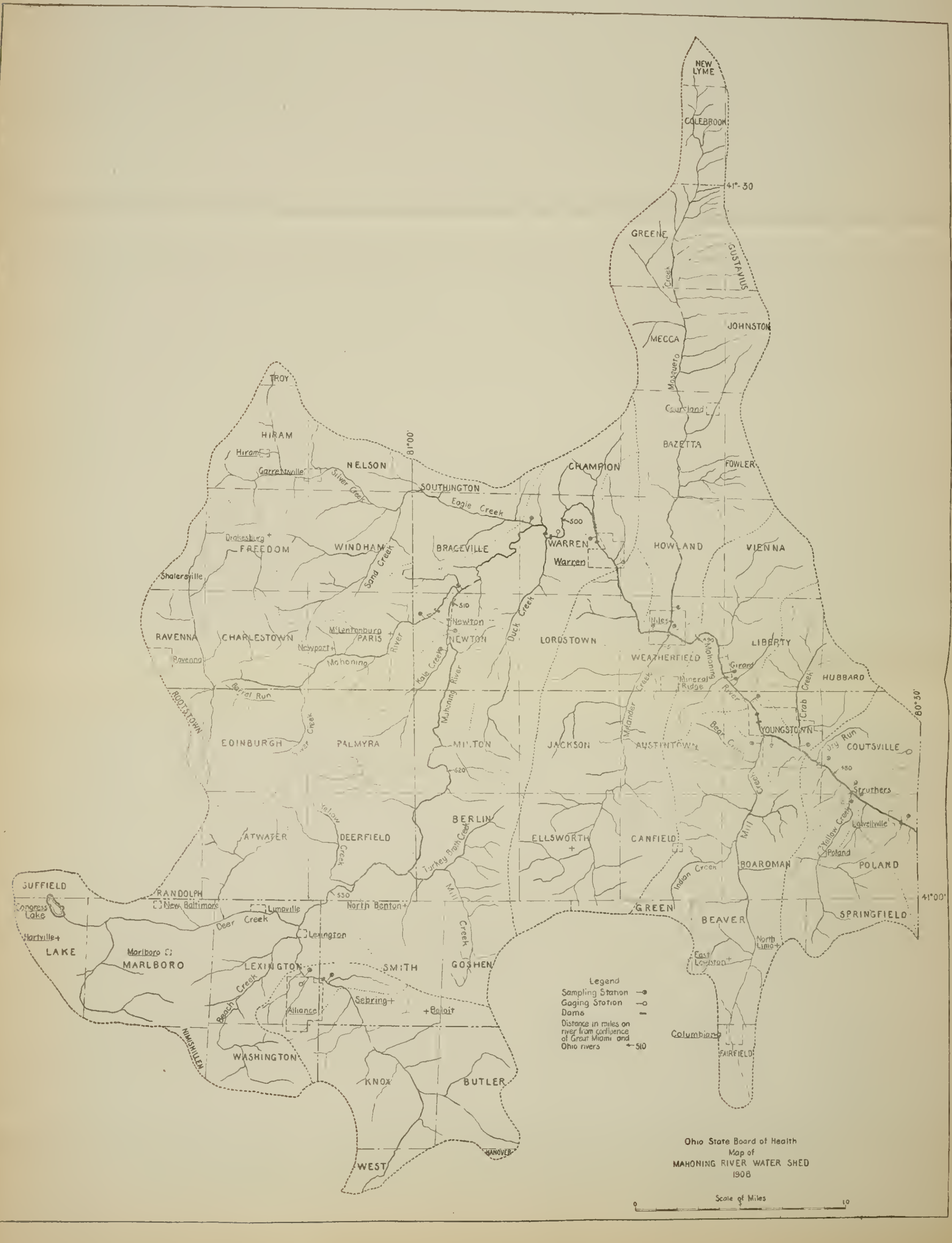
> ".......... No city, village, corporation or person shall introduce a public water supply or system of sewerage, or change or extend any public water supply or outlet of any system of sewerage now in use, unless the proposed source of such water supply or outlet for such sewerage system shall have been submitted to and received the approval of the state board of health. (O. L., v. 90, p. 94)."

In 1908 this act was amended to read as follows:

> "No city, village, public institution, corporation or person shall provide or install for public use, a water supply or sewerage system, or purification works for a water supply or sewage, of a municipal corporation or public institution, or make a change in the water supply, water works intake, water purification works of a municipal corporation or public institution, until the plans therefor have been submitted to and approved by the state board of health. No city, village, corporation or person shall establish a garbage disposal or manufacturing plant having a liquid waste which may enter any stream within twenty miles above the intake of a public water supply until the location of such garbage or manufacturing plant, including plans for disposing of such liquid waste, is approved by the state board of health. Whoever violates any provision of this section shall be fined



Ohio State Board of Health
Map of
MAHONING RIVER WATER SHED
1908



Ohio State Board of Health
Map of
MAHONING RIVER WATER SHED
1908

not less than one hundred nor more than five hundred dollars. (90 v. 94 § 2; O. L., v. 99, p. 494.)"

Since the passage of the above acts, the Board has always used its influence and the powers thereby conferred to secure the introduction of safe water supplies and to protect those in use against additional contamination.

In 1908 the State Board of Health was given more comprehensive powers in that it was authorized by the legislature, upon the request of local authorities, to make the examinations necessary to determine whether or not existing sources of pollution of a stream should be removed. Grounds for removal are either a resulting public nuisance or the dangerous pollution of a stream or body of water used as the source of a public water supply.

By a special act of legislature in 1906, the State Board of Health was authorized to make an investigation of existing water and sewage purification plants in Ohio. Evidence obtained during this investigation has particularly indicated the close relation of such problems to the general health of a community.

A point developed during this special investigation by the Board is the close interrelation of problems of water and sewage purification and the necessity for central control to determine the degree of efficiency that should be accomplished by both water and sewage purification plants. For example, the increased growth of pollution in centers favorable to the development of manufacturing industries generally requires the use of a surface water for a public supply, and, unless purification plants are provided, also frequently results in the pollution of the same stream or body of water by the wastes of these communities.

One of the most important of such streams in Ohio used both as a source of public water supplies and for the disposal of the liquid wastes of the communities on its watershed is the Mahoning River, along whose banks are situated several rapidly growing municipalities and many industrial plants. Owing to the rapid increase in population on the watershed of this stream there has been a marked increase in the pollution of its waters during recent years. This has resulted in dangerously polluting some of the public water supplies and also in causing occasional public nuisances, especially during the warmer seasons of the year. Anticipating the requirement of early action by the Board to eliminate public nuisances or to conserve the quality of the river water where it is used for public supplies, the State Board of Health in 1908 undertook the examination of the Mahoning River to make a general study of the various uses of the stream by the different communities on its watershed and the effect which these uses have, particularly upon the character of the water in the river.

GENERAL OUTLINE OF REPORT.

The following report contains a description of the Mahoning River and its watershed; the methods and the results accomplished during a previous investigation of this river by the State Board of Health in 1898; a full description of the scope and nature of the work and the results accomplished during the recent investigation; and a statement of the conclusions reached by digesting the evidence obtained.

DESCRIPTION OF STREAM.*

The Mahoning River is one of the largest and most important streams in Ohio. It drains a basin of about 1,025 square miles, rich in mineral and agricultural wealth which is developed by a busy and rapidly increasing population. This valley is one of the most important manufacturing centers in the Middle West and has many large establishments which produce iron and clay articles from the abundant raw materials of the region. It is also well supplied with transportation facilities, since it is near the Great Lakes and since it contains branches of the four great trunk lines in the United States.

These very favorable conditions along the lower part of the stream have gathered there numerous large manufacturing plants which have drawn about them a somewhat dense population of the laboring classes. As the population has grown, public water supplies for domestic use and fire protection have become necessary at several of the communities along the banks of the river and the people have naturally turned to the river as a source of supply. The manufacturing establishments also require very large volumes of water, particularly those which manufacture iron products, and these large plants together with the municipalities discharge large volumes of liquid wastes into the stream. On this account the waters of the Mahoning River are continuously polluted so that without purification they are unfit for domestic use.

Location and Direction of Flow.

The Mahoning River has its source in the hills of western Columbiana County, from which it flows in a northeasterly direction through Mahoning and Stark counties. About eight miles from its source is the city of Alliance, the first community of considerable size on its watershed. From Alliance the stream flows a little east of north, passing through Portage County, the westerly edge of Mahoning County, and enters the southwest corner of Trumbull County near Warren, the county seat. From Warren the stream flows southeasterly through Trumbull County, passing the flourishing manufacturing towns of Niles and Girard at the county line. Below Niles the stream continues in a southeasterly course, entering Mahoning County and passes through the manufacturing city of Youngstown and the villages of Struthers and Lowellville to the Pennsylvania state line and finally into the Beaver River, a tributary of the Ohio River.

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* Report on Examination of Sources of Public Water Supplies, 1898, page 163.

Main Tributaries.

The character of the water in the main stream is, of course, largely determined by that of the main tributaries which are briefly described below.

West Branch of Mahoning River. About forty miles below the source of the river, at Newton Falls, there enters one of the largest tributaries of the stream, called the West Branch of the Mahoning River, which drains an area of 109.6 square miles. The watershed of this stream is generally flat and contains a rural population devoted largely to agriculture.

Eagle Creek. Eagle Creek, another large tributary of the Mahoning River, enters the stream about eight miles below Newton Falls and drains a territory very similar to that of the watershed of the West Branch of the river. Garrettsville, a village of about 1,230 inhabitants, and Hiram with a population of about 630, are located near the upper waters of Eagle Creek. At both these places there are a few small sanitary sewers and the usual sources of pollution, due principally to surface washings, particularly after local rains.

Mosquito Creek. The flow of the Mahoning River is largely increased at Niles, 54 miles below the source of the stream, where there enter two large tributaries, Mosquito Creek on the north and Meander Creek on the south side of the river. Mosquito Creek rises in the southern part of Ashtabula County and flows directly south, a distance of thirty miles, through a level and sparsely populated district. The northern part of the watershed contains extensive marshes and swamps, while the southern part is gently rolling land devoted to rural or agricultural industries. Cortland, a village of 550 inhabitants, is the only community of any size on the watershed and is about 12 miles above Niles. The village has no water supply nor sewerage system and no serious pollution enters Mosquito Creek at this point.

Meander Creek. Meander Creek rises in the northern part of Mahoning County and flows about fifteen miles north through a rolling valley on which there is a sparse population devoted largely to agricultural pursuits. Canfield, a village of 669 inhabitants, Mineral Ridge, population 813, and Mahoning County Infirmary, population 250, are the only points at which pollution may enter the creek.

Squaw Creek. Squaw Creek is a small stream that enters the river from the east above Girard and at a point about two miles below Niles. Near the mouth of the stream is situated a summer park which at one time was very popular and where there was a large attendance during the evenings and on Sundays, but at the present time is not largely attended.

Mill Creek. Near the center of the city of Youngstown, there enters a large tributary, Mill Creek, which has its headwaters in Columbiana County and flows north a distance of twenty miles through an agricultural region. The total area drained by the stream is about eighty square miles. Near the mouth of the creek at Youngstown, there is a popular summer park, which extends along a considerable strip of land on both sides of the creek for a distance of two or three miles.

Crab Creek. A small tributary entering the Mahoning River south of the center of the city of Youngstown is Crab Creek which, while not of itself important, is used as a drain for a considerable territory within the city. Storm water drains and sanitary sewers both discharge continually into this stream and render it very foul.

Yellow Creek. At Struthers, about 69 miles below the source of the river, there enters a small tributary called Yellow Creek which rises in Columbiana County and flows north a distance of eight miles through the southern part of the village of Struthers. This stream is important because it is used as a source of supply for the village of Struthers.

Dams and Ponds.

From Alliance to the state line there are to be found numerous dams and ponds originally built perhaps to store water used for developing power.

The first dam of importance is at Alliance, where the public supply is obtained from an impounding reservoir, formed above a small dam not far from the center of the city.

Below Alliance the next dams of importance are at Newton Falls, where two hydro-electric plants have recently been built, one on each branch of the river.

Again at Leavittsburg, about seven miles below Newton Falls, is another recently completed hydro-electric plant, for which the power is obtained from a pool stored above a new concrete dam, about 8 feet high.

About one mile above the center of the city of Warren is another pool, formed by the dam used to develop power for the present water works. Below Warren, perhaps two miles below the above mentioned dam, is a second pool formed by a dam, also provided for the development of water power. At Girard, about 10 miles below Warren, is one of the largest dams on the stream. The pool formed by this dam is perhaps 8 feet deep even during extreme low water and extends up stream for a distance of approximately eight miles.

Within the city of Youngstown are several small dams used to form pools from which the industrial plants obtain the water necessary for their uses.

At both Struthers and Lowellville, are large dams across the river. They are used to supply water to the steel industries at these points, and develop pools similar to that at Girard.

In general it is evident from the above discussion that from its source to the state line, especially during dry weather, the river forms a series of pools and ripples, a fact which is of great importance both as affecting the run-off of the stream and its powers of self-purification.

Municipalities on Main Stream.

In the following table are shown the several municipalities located along the banks of the stream together with their distances from the state line where the river enters Pennsylvania.

Municipality.	*Population.*	*Distance From State Line — Miles.*
Alliance	14,600	60
Newton Falls	1,000	37
Warren	12,000	24
Niles	8,000	17
Girard	3,500	11
Youngstown	75,000	6.7
Struthers	3,500	3.5
Lowellville	1,474	0.5

General Character of Watershed.

In general the entire watershed of the stream is rolling farm land free from extensive timber. Some of the larger tributaries drain clayey soil so that, while the waters of the main river are at times fairly clear, during floods and following local showers, its water carries considerable quantities of fine silt and presents a muddy appearance. At Youngstown and below, the river water is frequently red, due to the effect of ore dust from the numerous blast furnaces in operation along the river valley. The banks of the stream are generally low and above Warren are frequently covered with vegetation.

While the natural bed of the stream is gravelly, in the lower reaches, due perhaps to the effect of sedimentation upon the masses of mud carried during freshets, the stream bed is a sticky slime, generally foul on account of the large volumes of domestic sewage poured into the river beginning at Warren and continuing to Struthers.

Summary.

A review of the above description of the main river and its tributaries indicates that the centers of population on its watershed are located immediately adjacent to the main stream and below the city of

Warren. Above Warren, the river drains an agricultural region, sparsely settled, and on which the only serious source of pollution is at Alliance, 36 miles above Warren. At and below Warren, there is a very marked change in the appearance of the river valley. From this point to Lowellville, a distance of about twenty-four miles, are to be found very extensive iron and steel industrial plants around which are centered rapidly growing communities. Within this valley there are some of the most extensive steel manufacturing plants not only in Ohio, but in the United States. It is through this territory that the pollution of the river and the problem of its use both for domestic and industrial purposes is of very great interest and importance.

INVESTIGATION OF MAHONING RIVER DURING 1898.

As previously stated, the early investigation of the Mahoning River in 1898 by the State Board of Health, was undertaken largely on account of its responsibility acquired by law to examine and act upon all proposed water supplies. In the introduction to the report on this investigation, the general problem as understood at that time is well covered by the following quotation:

> "Among the question that should be fully answered in passing judgment upon a proposed water supply to be taken from some river, are: its general character; the volume of the stream at all seasons of the year; the area and character of its watershed, with the number of people living upon it; the kind and amount of polluting matters which get into it; where they enter relative to the point at which the supply is to be taken; and the probabilities of increasing pollution in the near future. In addition, by the aid of chemistry and bacteriology, we should seek to learn the actual condition of the river at various points and at different times of the year, that we may know how far natural agencies may be depended upon for the removal, or change to harmless forms, of the pollutions which have entered it. Knowledge of this kind can not be gained in a day, but requires long and careful investigation."

The investigation of the river during 1898 comprised three parts as follows: The preparation of a drainage map and the compilation of data showing the population per square mile on the watershed of the stream; the collection of samples at regular intervals for chemical analyses; the collection of samples for bacterial analyses; measurements of the stream flow; and a thorough inspection and study of the various sources of pollution by domestic and industrial wastes.

The data obtained during this investigation are still of great value as indicating the main sources of pollution of the stream and the effect of the natural agencies which cause its self-purification; but the changes in local conditions have made the detailed results of but little present value. On this account it is not considered necessary to describe fully the results accomplished during the 1898 investigation.

In general it may be said here, however, that at but two points, namely, above Alliance and above Warren, did the evidence indicate a normal, unpolluted river water. The points of greatest pollution in the river were below Alliance, Warren, and Youngstown, where conditions were such that the stream was at times very foul and objectionable on account of odors, especially during protracted dry weather.

The examinations at Niles indicated numerous sources of pollution of the river water at this point, pollution which was, however, apparently more than offset by the increased flow of the stream due to the discharge of Meander and Mosquito creeks into the river and by the acid wastes discharged into the river at Niles.

The industrial wastes were found to be of considerable importance as affecting the physical properties of the water, but no serious local pollution from manufactural wastes was observed.

SCOPE OF INVESTIGATION OF 1908.

The main features determined during the recent investigation of the Mahoning River, as shown below, will be discussed before describing the actual methods used in the field. Briefly stated these features are as follows:

1. Population on watershed.
2. Pollution by sewage and manufactural wastes.
3. Volume of flow.
4. Character of river water.
5. Self-purification.
6. Public water supplies.

Population on Watershed.

The population on the watershed of the stream is of course of considerable importance in determining the extent and character of the liquid wastes from the several communities which discharge their sewage into the stream. The United States census report showing the population in 1890 has been used and the present population has been estimated from this report.

Urban population is considered to include that of all communities provided with public water supplies or domestic sewers; the remainder is classed as rural.

Pollution by Sewage and Manufactural Wastes.

Pollution by sewage of both domestic and industrial origin, is, of course, one of the most important features which controlled the character of the investigation. In addition to the population data secured from cities and rural communities and the pollution resulting therefrom, information has been obtained at Alliance in regard to the purification of domestic wastes as accomplished by chemical precipitation of the sewage of that city.

The problem of determining the effect of the various manufactural industries on the character of the river water has required data relative to the character and extent of the wastes discharged from the several plants along the river. At the large rolling mills especially, very large volumes of water have been pumped from the stream to be used principally for cooling purposes. Information has been secured relative to the effect of this practice on the quality of the water.

The general character of the pollution of the river together with the nature of the domestic and industrial wastes have been learned through a series of field examinations relative to the composition of the river water at many sampling points. Such physical, chemical, and bacterial tests as seemed necessary were made to determine the character of the different types of wastes discharged into the stream.

An important feature of the investigation was to select such times for carrying on the field work that the results obtained should represent seasonable variations, especially the low flow conditions of continued dry weather and the average high water that generally occurs during late winter.

Prior to the beginning of the field examinations, there was made a trip of preliminary inspection and similarly a trip of final inspection during the preparation of the report.

Volume of Flow.

The discharge of the river is of marked significance with respect to the effect of dilution upon the fairly constant quantity of polluting organic matter poured into the stream along its course. The investigation embraced the establishment of gauging stations at Alliance and Leavittsburg, where daily readings of the depth of flow were secured. These readings afford information as to the variation in the stage of the river and the length of time a given set of flow conditions prevail. On account of the several dams and ponds below Leavittsburg, it was not considered feasible to locate gauging stations below this point. Current meter measurements were made of the flow of the river at both gauging stations and at several other points during each field examination.

Character of River Water.

The investigation has been conducted so far as possible in a manner intended to eliminate errors attributable to the analyses of samples shipped to a central laboratory. Field operations are, of course, limited to a certain extent so that it is not practicable to make complete sanitary analyses in the field nor are such thought to be necessary. The physical, chemical, and bacterial data obtained relative to the character of the Mahoning River water were as follows:

1. Color.
2. Temperature.
3. Turbidity.
4. Odor.
5. Oxygen consumed.
6. Nitrogen as free ammonia.
7. Chlorine.
8. Free carbonic acid.
9. Alkalinity.
10. Dissolved oxygen.
11. Incrustants.*
12. Sulphates.*
13. Iron.*
14. Number of bacteria per cubic centimeter.
15. An estimate of the number of B. coli per c. c.

The laboratory determinations, obtained from samples shipped by express to the laboratory of the State Board of Health at Columbus, embraced only determinations of oxygen consumed, nitrogen as free ammonia, and chlorine, except in the case of special samples, on which there were sometimes determined incrustants, sulphates, and iron. All other determinations were made in the field.

Self-Purification.

One of the most interesting problems studied during the investigation has been the question of the self-purification of the stream, particularly as shown by the reduction in total numbers on bacteria and B. coli. The longevity of B. coli in the Mahoning River water and the significance of various numbers of this organism has been one of the most important features determined during the investigation. The change in the character of the water as shown by chemical and bacterial analyses indicates, of course, the extent to which the stream is purified by natural agencies such as dilution; the action of sunlight; chlorophylic algae; natural sedimentation in the pools above the dams; and the aeration of the water at riffles and dams resulting in the oxidation of organic matter. All of these natural agencies of purification are of great importance and have been considered during the investigation.

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*Special determinations made on a portion of the samples.

Public Water Supplies.

An important feature of the investigation has been the examination of the several public water supplies of the municipalities along the stream, particularly with reference to the quantity of water available and its character from a sanitary standpoint. There has also been investigated the question of purification of the river water by mechanical filtration at Warren and Youngstown, and by storage and sedimentation at Alliance and the character of the impounded Yellow Creek at Struthers.

Four of the smaller communities, Newton Falls, Niles, Garrettsville and Hiram, do not use the river water but obtain ground water supplies, which have also been studied during the investigation.

METHODS OF CONDUCTING INVESTIGATIONS.

The investigation was made under the general direction and supervision of the Secretary, Dr. C. O. Probst, and the Chief Engineer, R. Winthrop Pratt, with Messrs. Philip Burgess and A. Elliott Kimberly, assistant engineers in direct charge, assisted in the field by Charles F. Long, assistant chemist.

The information obtained during the investigation entailed office, field, and laboratory work, supplemented by data secured by correspondence. There was first made a preliminary inspection of the river and its principal tributaries with a view to locating sampling and gauging stations and to obtaining information as a guide in planning the field work incidental to learning the flow of the stream and its tributaries, the general character of the river water and its pollution.

This preliminary examination continued from June 16 to 21, 1908. It was followed by three detailed examinations as follows:

July 13 to August 1, 1908.
September 29 to October 10, 1908.
February 8 to February 20, 1909.

On the first detailed examination there were established two gauging stations, one on the main river below Alliance, and one at Leavittsburg. Arrangements were then made for obtaining twice daily gauge readings at these two stations.

The first examination was made under ordinary summer flow conditions in the river; the second during a period of very extreme drought; and the third during a normal flood in the late winter after a more or less protracted period with little or no rainfall. The information learned through the general observations and the analytical studies carried out on these three detailed examinations was further supplemented by data secured on a final inspection made early in the month of August, 1909.

Character of Field Work.

A principal part of the investigation was the analytical determination of the character of the river water and that of some of the larger tributaries and the effect thereon of the pollution introduced at different points.

Sampling Stations. To obtain this information the entire watershed was divided in such a manner as to enable sampling stations to be located at such points as would indicate the effect upon the character of the river water caused by wastes discharged at a point or points above. While the sampling stations given in detail were not maintained throughout the entire investigation, in a general way the points at which samples were taken were as follows:*

Mahoning River.

Sebring pumping station.
Above Alliance and below Fish Creek.
Alliance water works intake.
500 feet below Alliance sewage outfall.
2 miles below Alliance.
4 miles below Alliance.
11 miles below Alliance.
Pricetown.
Newton Falls.
West Fork, Newton Falls.
Below East and West Forks, Newton Falls.
Intake Warren water works.
600 feet below last Warren sewer outfall.
Above Niles near water works.
Below Niles at Erie Railroad bridge.
Below Girard dam.
Above Youngstown at Briar Hill.
Intake Youngstown water works.
900 feet below Haselton bridge.
600 feet above Struthers dam.
1200 feet below Struthers dam.
300 feet below Lowellville dam.

In addition to these sampling station on the main stream, during the three field examinations samples were collected from the following tributaries:

Tributaries.

Sulphur Creek, above confluence with Sebring sewage.
150 feet below confluence with Sebring sewage.

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*See also watershed map.

1 mile below confluence with Sebring sewage.
2½ miles below confluence with Sebring sewage.
Creek which receives Sebring cellar drainage.
Creek at Patterson Road, Alliance.
Trail's Run.
Kale Creek.
Eagle Creek.
Young's Run.
Mosquito Creek.
Meander Creek.
Mill Creek.
Crab Creek.
Yellow Creek.

Sewage and Sewage Effluents.

Sebring crude sewage.
Fairmount Children's Home sewage effluent.
Alliance chemically treated sewage at outfall.
Effluent sewage plant Trumbull County Infirmary.

Manufactural Wastes.

Wastes from Ohio Steel Company, Youngstown, upper plant.

Wastes from Ohio Steel Company, Youngstown, lower plant.

Wastes from tube mills, Youngstown Sheet & Tube Company.

Wastes from steel plant, Youngstown Sheet & Tube Company.

Wastes from puddle mill, sanitary sewage plus acid pickling liquors, Youngstown Sheet & Tube Company.

Wastes from Struthers Furnace Company, Struthers.

Wastes from rod and wire mill, Youngstown Sheet & Tube Company.

Dehairing liquors, Ohio Leather Company, Girard.

Water Supplies.

Sebring.
Alliance.
Warren (water purification plant).
Niles.
Youngstown (water purification plant).
Struthers.
Garrettsville.
Hiram.

All of these sampling stations were chosen with a view to showing the pollution of the river at different points and the inter-relation of the sewage of one section of the watershed and the water supplies derived from the river at points nearer the state line. Both domestic sewage and industrial wastes are of course to be considered in this connection. The principal sampling stations listed above are also shown on the attached watershed map, and in conjunction with the population data hereinafter tabulated there may be readily determined the relation of a given sampling point to the population on the watershed above a given point.

Collection of Samples. The sampling stations above listed on the main river were of two kinds, known as serial and individual stations, respectively. The serial stations were located above and below the larger communities; that is, above and below points of maximum population density. At these stations during each field examination, samples were collected for approximately twenty-four hours at intervals of about six hours. By this means there was obtained information as to the effect of the varying pollution upon the waters of the stream during a twenty-four hour period. The points at which the serial samples were collected are shown clearly in the tables of analytical data appended to this report. A list of the points at which serial samples were collected is as follows:

Above and below Alliance;
Alliance sewage outfall;
Above Newton Falls;
West Fork, Newton Falls;
Below confluence of East and West Forks, Newton Falls;
Intake Warren water works;
Effluent Warren water purification plant;
Below Warren;
Above Niles;
Below Niles;
Below Girard dam;
Briar Hill;
Youngstown water works intake;
Effluent Youngstown water purification plant;
Haselton bridge;
Above and below Struthers;
Lowellville.

At all of the other points on the main river and true also of the tributaries, single samples were collected for analysis on a given examination. The same is true also of industrial wastes.

The serial and individual samples were immediately analyzed by the aid of the portable field laboratory used throughout the investigation.

Number of Samples Collected. During the three field examinations there were collected for the field chemical and bacterial tests, 275 samples. The number of samples collected on each of the examinations is shown in the following table:

TABLE No. 1.

NUMBER OF SAMPLES COLLECTED.

Source.	1st.	2nd.	3rd.	Total.
Main river	63	53	56	172
Tributaries	15	11	5	31
Water supplies	12	13	22	47
Sewage and sewage effluents	6	6	3	15
Manufactural wastes	4	6	0	10
Total	100	89	86	275

Miscellaneous Field Work. In addition to the collection of samples and the analytical work pertaining to their analysis, during the field examinations information was obtained from local officials relative to population statistics, water supplies, sewer systems, etc.

POPULATION ON WATERSHED.

In a problem of this character it is essential to know with some degree of accuracy the population at any point on the stream at which pollution enters. To this end, for the purposes of this investigation, advantage was taken of a large watershed map of the state of Ohio, prepared in 1898 under the direction of Mr. Allen Hazen of New York City. By means of a pentagraph the watershed of the Mahoning River was enlarged to the size shown in the map attached, the scale of which is 1.645 miles per inch and 2.83 square miles per square inch. This map was then corrected in certain small details, all of the more important watershed lines were drawn in, and the areas of the watersheds of all of the larger tributaries were learned by the use of a planimeter.

The population on a given watershed was then estimated as follows: From the census of 1890 and 1900, city, village, and township populations were exterpolated for 1909 by adding to the population in 1900 nine-tenths of the algebraic difference between the populations shown by the census of 1890 and that of 1900. In any given watershed by the aid of the planimeter there was then determined the proportion of a given township lying within the watershed. The population in a township was then proportioned according to these areas and there was determined that portion of the population of the whole township which may be assumed to be within the watershed in question, of course with the assumption that the density of population is substantially the same within a given township. The populations are classed as total and rural as indicated.

From the table shown below, it appears that the total population on the watershed of the Mahoning River from its source to the state line, a distance by river of about 72 miles, is practically 167,000, corresponding to 163 persons per square mile. The rural population is about 45,500, or 44 persons per square mile.

From Alliance to the state line the rural populations average from 39 to 54 per square mile. Passing down the river to the state line, there is a considerable decrease in the rural population and an increase in the urban population, as in the lower Mahoning River valley the population is very dense and largely within incorporated communities. The maximum total population per square mile is just below Alliance and is 259 per square mile. The total populations on the watershed range from 71 to 259 persons per square mile. The area of the entire watershed is about 1025 square miles. This figure differs slightly from that cited in the report of the Ohio State Board of Health for 1898. It is to be mentioned that this difference is very probably due to the fact that later surveys available for this report show slight extensions to the watershed lines in some instances.

A detailed statement of the population on the watershed of the Mahoning River at different points on the main stream from its source to the state line is given in the following table:

TABLE No. 2.

POPULATION ON WATERSHED.

Point on Stream.	Distance above State Line. (miles.)	Area of Watershed (sq. miles)	Population.			
			Rural.	Total.	Per Sq. Miles	
					Rural.	Total.
Above Alliance*	61.5	66.5	3,408	5,408	51	81
Below Alliance	59.3	78.5	4,258	20,250	54	259
Below Alliance	55.8	199.0	10,264	26,264	52	132
Above Newton Falls	37.2	326.0	15,772	31,772	48	97
Including West Fork	35.2	436.6	19,142	35,142	43	80
Including Eagle Creek	29.1	526.2	22,116	40,020	42	76
Above Warren	24.0	585.7	24,006	41,910	41	71
Below Warren	21.6	596.5	24,690	54,594	41	92
Above Niles	18.5	606.6	25,229	55,123	41	91
Including Mosquito Creek	17.2	727.1	29,188	59,082	40	81
Including Meander Creek	16.8	813.0	32,700	62,594	39	76
Below Niles	15.8	818.0	33,081	70,975	40	87
Above Youngstown	10.7	855.0	35,586	76,980	41	90
Below Youngstown including Mill and Crab creeks	6.7	965.0	42,458	158,852	44	164
Below Struthers including Yellow Creek	3.5	991.0	43,507	163,401	44	165
State Line	0.0	1,025.0	45,506	166,874	44	163

*Source of river 72.5 miles above state line.

PRINCIPAL SOURCES OF POLLUTION BY DOMESTIC AND INDUSTRIAL WASTES.

From the headwaters of the river above Alliance to the point where the stream flows across the state line, the Mahoning River receives marked pollution through domestic sewage and manufactural wastes. In general, the pollution by domestic sewage is confined to points immediately below and within the corporate limits of the different municipalities located on the banks of the stream. At these points also, and as well in some instances at points apart from these population centers, polluting manufactural wastes flow into the stream. As it flows toward the Pennsylvania state line the river is thus intermittently polluted anew.

All of the more important sources of pollution of the main stream and its tributaries were investigated during the field examinations and are next considered at some length.

Above Alliance.

Practically the only pollution which the river receives above Alliance, save for that introduced at East Alliance, as will be later discussed, is the discharge into one of its tributaries of the raw sewage of the village of Sebring.

Sebring is a village of about 2,000 inhabitants, located in Mahoning County and directly upon the watershed of Sulphur Creek which enters the Mahoning River about two miles above the Alliance water works dam through Fish Creek. The village has a public water supply, a partial system of sanitary sewers and a few so-called cellar drains. The sanitary sewers extend in a northwesterly direction and during this investigation discharged into Sulphur Creek without further treatment.

Sulphur Creek rises in an abandoned coal mine and as shown by analysis, its water is acid, is highly impregnated with iron, and is very hard. The iron salts as precipitants for the Sebring sewage, with the result that there is removed from the sewage a large percentage of the suspended and dissolved organic matter and bacteria. This condition may be said to arise only during dry weather, for during floods and high water the accumulated deposit from the mixed sewage and Sulphur Creek water is washed along into Fish Creek and eventually enters the Mahoning River above the intake of the Alliance water works.

East Alliance.

At East Alliance, about one-half mile above the Alliance water works dam and intake, the river receives considerable pollution from several brooks and a large storm sewer. From a point above Alliance, proceeding downstream, these sources of pollution are as follows:

Lake Park. Lake Park is a pleasure resort operated by The Stark County Railroad Company and is about one mile northeast of East Alliance. There is a small lake at the park said to be fed by springs. The railroad company has quite extensive car barns and shops at this point and a number of the employees live nearby. Perhaps a dozen houses have been constructed. These are some 100 feet distant from the bank of the Mahoning River. There are no water carriage sewerage facilities; dry closets are in use. With proper care, except perhaps under very unusual flood conditions, no extensive pollution is to be anticipated at this point in the river.

Plum Run. This stream is about half a mile southeast of Alliance and flows across the county line. It is said to receive a large part of its water from springs near watercress beds several miles distant. From casual observation, the pollution of this stream does not appear to be especially noteworthy.

Mahoning River North of State Street. At this point enters a small brook which flows towards the Mahoning River. The stream is apparently but little polluted as it flows through a somewhat sparsely populated rural district.

Aulds Street and Mahoning Avenue. At this point in East Alliance, near the Alliance Machine Company, there is a small brook which receives land drainage and especially water from an abandoned coal mine. This water appears to be quite highly impregnated with iron.

Oyster Run. This small stream is said not to receive much domestic sewage. However, it contains considerable iron from an iron spring near its source.

East Alliance Curb Drain. There is a surface street drain at East Alliance which also may increase the pollution of the river. Although there has been a more general introduction of sanitary sewerage since conditions at East Alliance were investigated in 1898, it appears, however, that some foul matters are discharged into this curb drain and thus constitute a menace to the Alliance water supply.

Trail's Run. This small stream enters the Mahoning River about 500 feet east of the run just described. It, no doubt, receives considerable sewage pollution.

Franklin Street, North of Reed Street. At this point there is a ditch which discharges a certain volume of water into the Mahoning River. The ditch is lined with privies and carries considerable sink slops. No doubt during rainy weather considerable pollution reaches the river from this source.

Webb and Reed Streets Storm Sewer. This storm sewer is very foul and naturally receives considerable polluting material such as sewage and sink wastes.

Kingston and Liberty Streets. At Kingston and Liberty streets there is an open ditch into which discharge a number of sinks and into which flows some domestic sewage.

Alliance.

Below the water works dam, in a northwesterly direction towards the new effluent outlet of the sewage treatment plant, there are several small runs or brooks which are more or less polluted. The most important of these is Lamborn's Run which is an open ditch adjacent to the chemical treatment plant. This ditch drains considerable territory in Alliance and is said to receive considerable domestic sewage as well as more or less waste from a packing plant located near the center of the city.

Alliance to Newton Falls.

Just below Alliance at the outfall of the Alliance sewage plant, the river receives very gross pollution from the clarified sewage of the city. Alliance has a population of 14,850 and a daily flow of sewage of about 1,600,000 gallons. This sewage is partially treated with lime and then settled, but the organic matters by these processes are not sufficiently removed to prevent the gross pollution of the river at the point of the discharge of the clarified sewage into the Mahoning River.

The estimated number of persons connected to the Alliance sewers is 6,500. The approximate minimum dry weather flow of the Mahoning River measured immediately below the Alliance effluent sewer outfall on August 3, 1908, was 5.5 second feet. Correcting for the volume of sewage, the actual flow of the river was 3.1 second feet. On this basis the quantity of river water available for the dilution of the Alliance chemically treated sewage is, during the very low stages in the river, only 0.43 second feet per 1,000 persons who discharge sewage into the river at this point. Previous investigations of the Board have shown that the present chemical treatment practiced at Alliance affords merely a rough clarification of the sewage and an effluent which is still highly putrescent. At all times during dry weather the pollution of the Mahoning River below the Alliance sewer outfalls is very marked and is distinctly a public nuisance.

The industrial waste pollution at Alliance is not noteworthy since liquids derived from the manufacturing plants in the city are, for the most part, discharged into the city sewers.

In the stretch of about 22 miles by river between Alliance and Newton Falls, the river receives practically no pollution. There are no communities of any size near the stream nor on its tributaries, and there are practically no manufacturing establishments, no public water supplies, and no sewerage systems.

Newton Falls to Warren.

Newton Falls, a village with a population of 1,000, during this investigation had no public water supply and no sewerage system. There are several mills operated by water power between Newton Falls and Warren, but save for the wastes from a small creamery located on the East Fork of the Mahoning River, a short distance below Newton Falls, very little polluting material reaches the river.

At Newton Falls there enters the West Fork of the stream which drains a watershed of 110.6 square miles extending west to include a part of the city of Ravenna, the drainage of which is but slight within the watershed. The population on the West Fork is almost entirely rural; there are no noteworthy manufacturing establishments and practically no pollution to be considered.

Eagle Creek, another very large tributary of the river, joins the main stream about one mile above Leavittsburg. Eagle Creek drains an area of 89.6 square miles, most of which is devoted entirely to agriculture. There are two incorporated communities on the watershed, Garrettsville and Hiram. Garrettsville has a population of about 1,200 and Hiram 610. Both of these villages have public water supplies but no sanitary sewers. They drain into a branch of Silver Creek, a tributary of Eagle Creek. The pollution which enters Silver Creek at Garrettsville and Hiram is small and comprises several private drains and storm sewers.

Some sewage enters Duck Creek at Leavittsburg from the Erie Railroad station and also from a large stock farm, but the volume of this sewage is so slight that it cannot be considered of marked importance relative to the pollution of the Mahoning River, although of course, it may have some effect upon the bacterial character of the river water at the Warren water works intake.

About one mile above the intake of the Warren water works at the Warren water works dam, there enters Young's Run, a small stream which is of special interest since located upon its banks is the sewage purification plant of the Trumbull County Infirmary. This institution has a population of about 90 and discharges daily about 3,300 gallons of sewage. Before its discharge into Young's Run this sewage is treated in a plant which comprises a settling tank and two filters constructed of crushed coke and operated as intermittent sand filters. Formerly the sewage from this institution flowed untreated into Young's Run and was thus a distinct menace to the water supply of Warren.

Warren to Niles.

At Warren there may be said to begin the pollution of the lower Mahoning River by sewage. Warren is a city of 10,000 to 12,000 people and is quite extensively engaged in manufacturing, but in practically no case do the industries produce objectionable wastes. The sewage of the city during this investigation was collected principally in a system of combined sewers but partly in one built on the separate plan.

Along the river front within the city limits there are 13 different sewer outfalls of which 8 are combined and 5 sanitary sewers, and also a number of private sewers. The character and sizes of the sewers are shown in the following table:

TABLE No. 3.

DATA ON WARREN SEWERS.

Sewer.	Character.	Size. (inches.)
Dickey Run	Sanitary	9
Hunter Street	Sanitary	9
Stiles Street	Sanitary	8
Market Alley	Combined	36
West South Street	Combined	12
Foster Gulch	Combined	24
Summit Street	Combined	18
Main Street	Sanitary	15
West South Street	Sanitary	8
Pine Street	Combined	24
Red Run	Combined	24
First Street	Combined	20
Buckeye Street*	Sanitary	9
Buckeye Street*	Combined	12

*Combined outlet.

The total mileage of sewers to August 1, 1909, is said to be 27.

According to information obtained from the Warren officials, 7200 persons are estimated to be connected to the Warren sewers, or 60 per cent of the total population. It is further stated that over 500 dry closets are in use.

A fair estimate of the dry weather flow of the Mahoning River was obtained from the gauging station at Leavittsburg during the second field examination. The flow of the river was 709 second feet, or 45,000,000 gallons in twenty-four hours. On this basis and estimating that 7200 persons are tributary to the sanitary sewers, the dry weather flow relation of the population connected to the sewers and the flow of the stream is 9.8 second feet per 1000 persons who discharge sewage at this point. Based upon a total population of the city of 12,000, the available dilution expressed in these units is 5.9 second feet per 1000 persons.

The larger sewers of the city are on the combined plan and presumably show a high ground water leakage. During this investigation the flow of sewage in the Pine Street sewer was weired and observations thereon were made for four days—from July 24 to 27, inclusive. The rate of flow on these days measured at different times in the morning and afternoon ranged from 312,000 to 423,000 gallons in twenty-four hours. These gaugings were made during dry weather; no rain whatever fell while the measurements were obtained. The results of the measurements are shown in the following table:

TABLE No. 4.

PINE STREET SEWER GAUGINGS.

Date—1908	Hour.	Gallons in 24 Hours.
July 24	3:00 P. M.	423,000
July 24	4:45 P. M.	350,000
July 25	7:45 A. M.	366,000
July 25	12:45 P. M.	324,000
July 25	3:00 P. M.	324,000
July 25	5:45 P. M.	312,000

Niles to Girard.

At Niles the Mahoning River receives some domestic sewage from the city and industrial establishments and some manufactural wastes. within the city limits there enters Mosquito Creek which in Niles is grossly polluted by the sewage from five of the sewers of the city.

Domestic Sewage. The city of Niles has a population estimated at 8,000 and lies on both sides of the Mahoning River. It is a manufacturing city, engaged chiefly in manufacture of steel and iron products. Its water supply is derived from driven wells, supplemented at times by raw Mahoning River water. There exist about 4.97 miles of sanitary sewers and about one mile of storm sewers. The population locally estimated to be connected with these sewers is 2000.

At Niles there are 7 sewer outlets. 2 of which discharge into the main river and 5 into Mosquito Creek. The location. size, and character of these sewers is as follows:

TABLE No. 5.

DATA ON NILES SEWERS.

Sewer.	Character.	Size. (inches.)	Point of Discharge.
Chestnut Street	Combined	26 x 39	Mahoning River.
Main Street	Combined	....	Mahoning River.
Frankling Avenue	Sanitary	8	Mosquito Creek.
Vienna Avenue	Sanitary	10 x 12	Mosquito Creek.
Vienna Avenue	Storm	20 x 30	Mosquito Creek.
Church and Park Aves.	Sanitary	18	Mosquito Creek.
Robbins Avenue	Combined	12 x 24	Mosquito Creek.

Early in 1908 in providing additional sewers for the city it was recognized that a sewage purification plant would be necessary. Plans were prepared early in 1908 and were approved by the State Board of Health. Up to the present time the plant has not been constructed. The sewers which enter Mosquito Creek near the Robbins Avenue bridge and a short distance below cause very marked pollution and constitute a public nuisance, especially in dry weather when there is practically no flow over the Mosquito Creek dam.

In addition to the sewage from the city of Niles, there is considerable pollution from the industrial establishments along the river and on Mosquito Creek within the corporation limits. Including the industrial population of the manufacturing concerns in Niles and the total population of the city connected to the sewers, it is estimated that at Niles the sewage of a population of 3150 indirectly or directly reaches the Mahoning River.

Manufactural Wastes. At Niles there may be said to begin the manufactural waste pollution of the Mahoning River. During this investigation the large steel plant at Niles was not in operation.

The first industrial pollution is that from the Empire Steel Company located on the south bank of the river about one mile below Main Street, in Niles. This company is engaged in the manufacture of sheet steel and employs about 400 men.

On the north side of the river about one mile below the corporation limits of the city is the plant of the Ohio Galvanizing & Manufacturing Company. This concern employs about 125 men and is engaged in the manufacture of several kinds of galvanized iron products.

Below this plant about one mile is that of the Thomas Steel Company, which employs about 450 men and is engaged in the manufacture of sheet steel.

Each of these three concerns carries on considerable galvanizing prior to which the steel is immersed in baths of sulphuric acid and muriatic acid. The spent pickle, or acid iron waste is a by-product which is discharged into the river. From information obtained from the three plants, it is estimated that there is discharged into the river daily about 5.8 tons of sulphuric acid and about 0.5 ton of muriatic acid in the form of iron salts. At three points on the river just below these three plants there enters acid iron wastes which impart a marked brownish red color to the water and produce a marked precipitate of oxide of iron.

The sewage from all of these plants is discharged directly or indirectly into the river.

Continuing towards Girard, distant about 4½ miles from Niles, there enters the river Squaw Creek, a stream which carries the wastes from the Ohio Leather Company. This concern is engaged in the preparation of calf skins and employs about 275 men. The plant uses about 250,000 gallons of water daily, obtained from driven wells. The wastes from the plant comprise the sewage of the employees, spent dehairing liquor, spent dye liquor, and spent tanning liquor. The two last wastes considerably discolor the stream but are by no means of such importance as the dehairing liquor. This waste is discharged in considerable volume and contains a mixture of commercial quicklime, white arsenic, and organic matter from the hides. It is an exceedingly offensive waste.

The tannery sewage drains directly into Squaw Creek at a point about 1000 feet from the confluence of this stream with the Mahoning River; during dry weather this small tributary is practically dry save for the wastes from the leather works. From the plant to the Mahoning River the creek is very offensive. It is covered with a hairy slimy deposit which emits a strong fishy odor and is very objectionable.

Another source of pollution from this plant is the heap of refuse discharged into Squaw Creek near the plant, there to await a rise in the creek to carry it into the Mahoning River.

A very small soap works located near the tannery contributes some odor and possibly a small volume of waste, but this pollution is very insignificant and probably it has no very marked effect upon either Squaw Creek or the Mahoning River.

Tributaries. At Niles there enters on the north bank Mosquito Creek and on the south bank Meander Creek, both within the city limits. Mosquito Creek is a large tributary of the Mahoning River, extends north about 30 miles, and drains an area of about 120 square miles. Its watershed is sparsely populated and the only community of any size is Courtland, distant about 12 miles from Niles. Courtland has no sewers and the only pollution that enters Mosquito Creek at this point is the usual drainage from outhouses, pigpens, etc. Within the city of Niles the stream receives very decided pollution from the sanitary sewage of Niles. This is particularly pronounced within the city below the point at which Mosquito Creek is dammed.

The extensive watershed of this stream affords considerable flow in wet weather, and this flow is then available for diluting the sewage and other wastes which enter the river at Niles and below. During dry weather, however, the flow of this stream is very slight and the dilution it affords is insignificant.

Meander Creek has a watershed of about 86 square miles and drains a rural district in the central part of Mahoning County. On its watershed are two villages, Canfield and Mineral Ridge. Canfield is a small village with a population of about 670 and lies on the divide between Meander and Mill creeks. Only the ordinary surface drainage from a village enters the stream at Canfield, since there are practically no public improvements in the village.

Mineral Ridge lies several miles south of Niles and about on the divide between Meander Creek and Mill Creek. The population of the village is about 850. Mineral Ridge is not on any stream. It has no water supply, no sanitary sewers, and probably contributes but little pollution to Meander Creek.

About 1½ miles northwest of Canfield is the Mahoning County Infirmary, situated on one of the main branches of Meander Creek. The population of this institution averages about 300. The institution has an abundant water supply, baths, laundry, and modern sanitary conveniences. The sewage from the infirmary flows directly into a feeder of Meander Creek and is thus a source of pollution.

Girard to Briar Hill.

The village of Girard has a population of about 3500. During this investigation the village had no water supply and but few sanitary sewers. In 1909 a water supply and a system of sewers has been provided; neither of these improvements has been completed. Up to the first of August, 1909, there is stated to have been constructed about 6.7 miles of sanitary sewers. The sewage is eventually planned to be conducted to a sewage purification plant.

From Girard to Briar Hill there are no other incorporated communities, although there is a considerable population along the north shore of the river and possibly a certain volume of sanitary drainage enters the river from this section.

There are few industrial establishments between Girard and Briar Hill. The Girard Furnace Company located on the river below the Girard dam, employs about 500 men. This plant uses large volumes of water for cooling purposes. Sanitary drainage from the plant enters the river.

The Standard Oilcloth Company, engaged in the manufacture of oilcloth, is located about two miles below Girard and distant about 3000 feet from the river. It employs about 70 men. The sanitary wastes are conducted to a cesspool from which settled sewage overflows into a shallow ditch; presumably this sewage is considerably purified before it reaches the river. There are no manufactural wastes from this plant.

Briar Hill to Intake Youngstown Water Works.

Beginning at Briar Hill, about 2½ miles above Central Square, Youngstown, the river receives decided pollution from domestic sewage and sanitary drainage. A notable source of pollution, particularly during sharp local showers, is the run-off from the thickly settled and but little sewered section of Youngstown and the suburban district just southeast of Briar Hill. Between Briar Hill and the intake of the Youngstown water works, there enters tuyere and condenser water, and other wastes from some of the largest steel mills near the city. The pollution sustained by the river between the above points is of special importance since the water supply of the city of Youngstown is derived from the Mahoning River after purification in a mechanical filter plant.

Mill Creek. Mill Creek enters the Mahoning River at a point about three-fourths mile above the intake of the Youngstown water works. This stream has a watershed of about 76 square miles and drains a farming district which extends into Columbiana County. The village of Columbiana is at the headwaters of the creek. This village has no sanitary sewers but has a public water supply, and hence some sanitary drainage may enter Mill Creek at this point.

A short distance from Youngstown on the banks of Mill Creek is Idora Park, a pleasure resort said to be frequented by from 10,000 to 15,000 people on Sundays and holidays. There is considerable sanitary drainage from the park.

The Glenwood Children's Home is on Mill Creek. The sewage of its population of about 25 receives treatment at a sewage purification plant before it reaches the creek.

Intake Youngstown Water Works and Haselton Bridge.

Between the intake of the Youngstown water works and Haselton bridge, a distance of about 2½ miles, there enters all of the sewage of the city of Youngstown, and drainage and cooling water used in the steel mills between these two points.

Domestic Sewage. The city of Youngstown has a population conservatively estimated at 75,000, of which a considerable part is foreign born because of the large number of this class employed in the various steel plants located in the city and along the river within the corporate limits. Youngstown has a system of sewers, chiefly on the combined plan. There are 5 separate outlets directly into the river and 11 into Crab Creek. The character, size, and location of the Youngstown sewers is shown in the following table, based on information obtained from the city engineer:

TABLE No. 6.

YOUNGSTOWN SEWER DATA.

Sewer.	Character.	Size. (inches.)	Point of Discharge.
Maple Avenue	Combined	18	Crab Creek.
Covington Street	Combined	36	Mahoning River.
Holmes Street	Combined	48	Mahoning River.
Oak Hill and Mahoning	Combined	48 & 68	Mahoning River.
Market Street	Combined	48	Mahoning River.
Main sewer	Combined	84	Crab Creek.
Sheehy Street	Combined	30	Mahoning River.
Emerald Street	Storm	32	Crab Creek.
McGuffey Street (2)	Combined	36 & 36	Crab Creek.
Emerald Street	Sanitary	18	Crab Creek.
Oak Street	Combined	36	Crab Creek.
Broadway (2)	Combined	32 & 36	Crab Creek.
Thorton	Storm	15	Crab Creek.
Wick Avenue	Combined	18	Crab Creek.

The river at Youngstown is used by practically all of the larger steel mills for cooling and condensing purposes, also as a medium for the discharge of the sanitary drainage from these plants. A number of low dams have been built in the river at several points beginning at Briar Hill and adjacent to each of the larger steel mills, with a view to forming pools from which water may be drawn for use within the mills. The intake and the discharge in such cases is usually located on the upstream side of these small dams and thus under low stages of the river the water is used repeatedly, thereby receiving continually increasing pollution and gradually increasing in temperature.

With an estimated dry weather flow of about 15,000,000 gallons in twenty-four hours, or about 23.3 second feet, and assuming that the sewage from that a population of about 67,000 (including the industrial population) enters the river between Briar Hill and Haselton bridge, the average dilution available for the disposal of the sewage of the city is only 0.36 second feet per 1,000 persons the sewage of whom is discharged into the stream. A marked pollution by domestic sewage is thus indicated.

Manufactural Wastes. It is estimated that under average conditions the sewage of about 17,000 mill operatives directly or indirectly enters the Mahoning River at Youngstown from Briar Hill to Haselton bridge. The surface of the stream in the stretch between Briar Hill and Haselton bridge is oftentimes covered with ore dust which imparts a brownish red color to the water. The large steel mills between the above points contribute but little waste of a strictly industrial nature save perhaps from oil and graphite. The enormous volumes of cooling water are, however, considerably polluted and their comparatively high temperature materially raises that of the river water.

An idea of the extensive manufacturing interests in Youngstown may be formed by the following list of the larger concerns which are located chiefly along the banks of the Mahoning River. The various plants are listed in order from Briar Hill to the Haselton bridge.

Principal Manufacturing Plants at Youngstown.

Briar Hill Iron and Coal Company.
Youngstown Steel Company.
The Carnegie Steel Company. Ohio Works.
The Carnegie Steel Company. Upper Mills.
The Carnegie Steel Company. Lower Mills.
(The National Tube Company.)
United Engineering Foundry, The Wm. Tod Company.
Republic Iron and Steel Company. Brown-Bonnel Works.
The Finished Steel Company.
The Youngstown Iron and Steel Roofing Company.
Youngstown Car Works.
The Republic Iron and Steel Company, Andrews Works.

NOTE: Located on Crab Creek is the large plant of the Republic Iron and Steel Company, Valley Works and the W. B. Tod Company.

Haselton Bridge to Struthers.

Below the Haselton bridge on the north side of the river, is the very large plant of the Youngstown Sheet and Tube Company. This plant not only discharges into the river large volumes of tuyere and condenser water (40.000.000 to 50.000.000 gallons daily), but also considerable spent pickle or acid iron wastes and the sewage from 5,500 employees. The daily consumption of sulphuric acid is said to be roughly about 19,000 pounds. The liquid wastes from this plant, which extends along the river bank for a distance of about one mile, enter the river through eight drains of different sizes of which four are said to be used for sanitary purposes.

The effect of the entrance of the acid iron wastes is to impart to the water in the river a very red appearance due to the oxidation and precipitation of the iron. With it there is entrained a considerable part of the filth introduced from points above. In fact, below this plant to the dam at Struthers there is virtually sewage treatment by chemical precipitation. The grossly polluted condition of the river between this plant and the dam at Struthers is especially noticeable during low water in the river.

Struthers to Lowellville.

At Struthers the river is dammed and the pool thus formed affords an opportunity for the sedimentation of the coagulated masses of iron and organic matter introduced above Struthers, as just mentioned. Above the dam at Struthers there enter the cooling water from the Struthers Furnace Company, sanitary wastes from its 125 employees, and a storm sewer from the village of Struthers.

Below the dam a short distance is the mouth of Yellow Creek which carries acid iron wastes and sanitary drainage from two industrial plants.

Domestic Sewage. Struthers is a village of about 3,500 persons principally engaged in the manufacture of steel products. The village has a public water supply derived from an impounding reservoir on the watershed of Yellow Creek about three miles west of the town. During this investigation the water supply was but little used. Little sanitary sewage is thus created, but what small volume exists is discharged into the Mahoning River just above the Struthers dam. Pollution by domestic sewage at Struthers is not marked.

Manufactural Wastes. The sewage from the 125 men employed at the plant of the Struthers Furnace Company is discharged into the river above the dam, together with cooling waters in volume about 8,500,000 gallons daily. Waste from a water softening plant also enters the river at this point.

Most important for the present discussion is the sulphuric acid which enters Yellow Creek from the rod and wire mill of the Youngstown Sheet & Tube Company. According to the officials of the company, the daily consumption of acid is about 4,000 pounds. The spent pickle reddens the waters of the creek and forms a coating upon the bed of the stream. At low water the effect of these wastes introduced into the river through Yellow Creek is very pronounced. In the 3-mile stretch between Struthers and Lowellville, the backwater from the Lowellville dam causes a rapid sedimentation of the acid wastes which are in effect the secondary application of a coagulant to the partially clarified sewage and river water above the dam at Struthers.

Yellow Creek. Yellow Creek aside from the fact that it carries the wastes from the industrial plants below the Struthers dam, is of special interest since its waters are impounded about two miles above Struthers and are used for the public water supply of that village. Yellow Creek has a watershed of about 30 square miles and drains a sparsely populated rural district. The only community on the watershed is the village of Poland which has a population of about 390. Poland is located directly upon Yellow Creek at a point about one mile above the upper end of the Struthers reservoir. There are no domestic sewers in the village but there are one or two storm sewers which discharge directly into the stream. There may possibly be some pollution from cesspools and privy vaults, some of which are fairly near the stream. Further, some of the dwellings on the watershed are near small feeders of the creek, and possibly during heavy rains some pollution from this source is washed into the stream.

It is evident that the watershed of Yellow Creek receives but a limited quantity of continuous pollution. There are several opportunities, however, for pollution to enter the stream during heavy rains, and possibly during such times the turbid creek water will be somewhat polluted as it enters the reservoir. The character of the water is subsequently discussed with reference to the Struthers water supply.

Lowellville to State Line.

At Lowellville the river is again dammed for water power and under ordinary conditions the water is backed up almost to the foot of the Struthers dam and forms a large sedimentation basin.

The village of Lowellville has a population of about 1474 and during this investigation had no water supply and no general system of sanitary sewers. Several storm water drains enter the river at this place and these probably receive some sanitary drainage. The pollution from this source is, however, not marked. A further source of pollution is sanitary sewage from the three railroad stations at Lowellville.

The Ohio Iron and Steel Company at Lowellville employs about 150 men and discharges all of its drainage into the river. In general, the pollution introduced at Lowellville is insignificant.

Below Lowellville to the state line, a distance of about one-half mile, the river flows through a but sparsely settled rural district and hence receives practically no pollution.

VOLUME OF FLOW OF STREAM.

During the different examinations the volume of water flowing at different points in the river and in some of the tributaries was determined by the use of a current meter, or by floats. In addition, as already mentioned, there were established two gauging stations at which for a period of about ten months, gauge heights were observed twice daily, morning and evening. For the purposes of this investigation, information as to the flow of the river during the field examinations appeared to be sufficient for the proper interpretation of the analytical data. The daily gauge readings were arranged for with a view to learning the average stage of the river for a given period, and the length of time a given set of conditions would prevail. Current meter measurements were made only during the field examinations and not with sufficient frequency to cover the extreme high water of the river nor a wide range in the normal flow.

In addition to the current meter measurements made at the two gauging stations on the different examinations, similar measurements were made at several points as follows: East and West Forks, at Newton Falls, and on the main river a short distance below the Lowellville dam.

Gauging Station at Alliance.

The gauging station at Alliance was established on September 1, 1908, and thereafter observations were made twice daily until May 31, 1909.

Description. Owing to the comparatively poor location of the gauging station at Alliance and to the difficulty of measuring accurately the low flows of the stream, the gauging discussed below should be considered only approximate. The station is located on the upstream side of a highway bridge a short distance below the Alliance water works pumping station. The river is straight above the station for a distance of about 100 feet, and below for a distance of about 300 feet. The Alliance water works dam is about one-fourth mile above the station.

The chain gauge is bolted to the handrail of the bridge at approximaely station 0+. The marker is placed at 10 feet on the guage and the gauge box is graduated in tenths with tacks. The length of the chain below the marker to the end of the weight is 18.01 feet. The elevation of the center of the pulley is 44.96. The zero of the gauge is approximately at the bottom of the stream and is elevation 27.87.

All elevations are referred to a bench mark upon the north-west corner of the west abutment.

Flow of Stream. The flow of the Mahoning River at the gauging station in Alliance can be measured by current meter only during wet weather; in dry weather, therefore, the flow of the river was determined by floats at a point about 500 feet below the entrance of the Alliance sewage. Measurements with floats were made at this point on the first and second examinations. In the first instance the river was at a moderately low stage; in the second instance probably maximum low water conditions were recorded. On the third examination the river was in moderate flood, making possible measurements with the current meter at the gauging station.

In Table No. 7 are shown the flow data for the gauging station at Alliance corrected for the Alliance sewage flow in the case of the float measurements which were made below the Alliance sewer outfall. It is of interest to note that the city of Alliance withdraws from the stream daily about 3,600,000 gallons of water of which only about 1,600,000 gallons are returned to the river through the Alliance sewers. A considerable part of the remainder is used by railroads and another part by manufacturing concerns, which of course discharge a portion of this water directly or indirectly into the river.

TABLE No. 7.

FLOW OF MAHONING RIVER BELOW ALLIANCE.

1908-9.	Gage Height.	Measurement by	Mean Velocity.	Discharge.		Sewage Flow Sec.—Ft.	Cor'ctd Dis.	
				Sec. Ft.	Mil. Gals. 24 Hrs.		Sec.—Ft.	Mil. Gals. 24 Hrs.
Aug. 3	*	Floats	0.11	5.5	3.5	2.4	3.1	1.9
September 30	0.8	Floats	0.17	7.5	4.8	2.1	6.4	4.1
February 10	4.45	Meter	2.63	42.8	27.7	......	......	......

*Gauge not installed.

Gauge Readings. In Table No. 8 are recorded the average daily gauge heights and the average, maximum, and minimum readings by months for the Alliance gauging station during the ten months from August, 1908, to May, 1909, inclusive. These data are of considerable interest as indicating the period during which low water persists in the river and as well that of normal high water and flood water. The long continued drought in the fall of 1908 afforded exceptional opportunities for learning the maximum dry weather flow of the Mahoning River at this point near its source, and as the tabulated data indicate, extreme low water conditions corresponding to those which prevailed on the second examination, continued for 70 days, namely, from September 1, 1908, to November 1, 1908. The moderate dry weather conditions subsequent to this period are also indicated and as well the spring floods.

TABLE No. 8.

AVERAGE DAILY GAUGE HEIGHT AT ALLIANCE, SEPTEMBER 1, 1908, TO MAY 31, 1909.*

(Gauge readings in feet.)

1908-9.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May
1	0.8	0.8	1.3	1.3	1.7	1.9	2.4	2.1	6.0
2	0.8	0.8	1.2	1.3	1.7	1.8	3.0	2.0	4.0
3	0.8	0.8	1.2	1.3	1.7	1.8	3.7	2.0	3.0
4	0.8	0.8	1.2	1.3	1.7	1.9	4.7	2.0	2.9
5	0.8	0.8	1.2	1.3	1.7	3.2	2.7	2.0	2.8
6	0.8	0.8	1.2	1.3	3.0	3.3	2.6	2.7	2.5
7	0.8	0.8	1.2	1.6	2.0	2.85	3.2	6.0	2.1
8	0.8	0.8	1.2	1.6	1.75	2.3	2.9	4.1	2.0
9	0.8	0.8	1.2	1.5	1.7	2.25	4.15	2.9	1.9
10	0.8	1.0	1.5	1.5	1.7	4.25	6.5	2.7	2.3
11	0.8	0.9	1.6	1.6	1.7	3.15	4.2	2.5	2.6
12	0.8	1.0	1.5	1.6	1.7	2.4	3.15	2.3	1.9
13	0.8	1.0	1.4	1.6	1.85	3.65	2.75	2.6	1.9
14	0.8	1.0	1.3	1.6	2.3	4.1	2.7	3.5	1.8
15	0.8	1.0	1.3	1.6	2.5	5.7	2.4	2.8	1.8
16	0.8	1.0	1.3	1.6	2.1	4.6	2.1	2.3	4.0
17	0.8	1.0	1.3	1.7	2.0	3.1	2.1	2.0	2.4
18	0.5	1.0	1.3	1.8	1.9	2.6	2.0	2.0	1.9
19	0.8	1.0	1.3	1.7	1.75	3.5	2.8	1.9	1.8
20	0.8	1.0	1.3	1.7	1.8	6.6	3.4	1.8	1.8
21	0.8	1.0	1.3	1.7	3.8	5.3	2.3	2.3	3.0
22	0.8	1.0	1.3	1.7	4.8	3.9	2.2	3.2	3.1
23	0.8	1.0	1.3	1.7	5.9	5.2	2.0	2.8	2.3
24	0.8	1.1	1.3	1.7	6.0	9.5	2.0	2.3	1.9
25	0.8	1.3	1.3	1.9	3.8	5.5	3.9	2.1	1.6
26	0.8	1.3	1.5	1.9	2.6	3.5	4.0	2.0	1.7
27	0.8	1.3	1.5	1.18	2.2	3.35	3.3	2.0	1.8
28	0.9	1.3	1.4	1.18	2.0	2.9	2.6	2.0	2.2
29	0.8	1.3	1.3	1.7	1.9	......	2.3	3.2	1.9
30	0.8	1.3	1.3	1.7	2.6	......	2.3	9.1	1.8
31	......	1.3	......	1.7	2.2	......	2.3	9.1	1.6
Average	0.71	1.0	1.3	1.57	2.13	3.72	3.0	2.8	2.4
Maximum	0.9	1.3	1.6	1.9	6.0	9.5	6.5	9.1	6.0
Minimum	0.5	0.8	1.2	1.3	1.7	1.8	2.0	1.8	1.6

*Data are averages of observations morning and evening.

Gauging Station at Leavittsburg.

The gauging station at Leavittsburg was established on July 22, 1908, and thereafter beginning August 1, 1908, observations were made twice daily until May 31, 1909.

Description. The station is located on the downstream side of the Leavittsburg highway bridge. The river is straight for 500 feet above and one-fourth mile below the station. A dam with power development for a flouring mill is 1,000 feet above the station and a second dam for a hydro-electric plant is 500 feet above the station. The operation of the gates at these dams has, of course, influenced considerably the gauge readings and flow measurements at Leavittsburg. The station is directly within the settlement of Leavittsburg.

The chain gauge is nailed to the flooring outside of the handrail on the downstream side of the bridge at approximately station 0 + 50. The length of the chain is 35 feet. The gauge box is graduated at 10 feet to tenths with carpet tacks. The length of the chain to the marker is 24.83 feet.

Zero for soundings is the west abutment, east face. The water at the station is sluggish at low flows. There are several riffles below the station and the water is there swifter than above. The right bank is high and rocky and is subject to overflow immediately above the station. The left bank is fairly high and clean; it is also subject to overflow immediately above the station. The stream bed is rocky and not shifting and is free from vegetation. There is practically one channel at all stages.

The flouring mill operates about ten hours daily, except Sunday. The wheels are not rated. The hydro-electric dam operates continuously. Zero flow is about 0.6 on the gauge. The low flows are probably not very accurate.

The bench mark is a bolt head painted white, U. S. Geological Survey, in east end of north truss of the highway bridge on which the gauge is set. Elevation of bench mark = 898.20; elevation center of pulley = 896.30; zero of gauge = 872.42; elevation bottom of stream below gauge = 872.50.

Flow of Stream. The flow of the river at this station can be measured by current meter at almost all stages. Meter measurements were made on each of the three field examinations. The first measurements correspond to a moderate dry weather flow; the second to a maximum dry weather flow; and the third to moderate high water. Results of current meter measurements at this gauging station are shown in Table No. 9.

TABLE No. 9.

FLOW OF MAHONING RIVER AT LEAVITTSBURG.

1908-9.	Gauge Height.	Measurement by	Mean Velocity.	Discharge.	
				Sec.—Ft.	Mil. Gals. 24 Hrs.
July 22	1.7	Meter	1.45	19.7	12.7
October 5	1.1	Meter	0.81	7.1	4.6
February 12	3.6	Meter	2.4	83.7	54.0

Gauge Readings. In the next table are shown the average daily and average maximum and minimum gauge heights observed at this station. These data indicate the length of periods of flow and high water, respectively, and are of importance in the broad interpretation of the analytical data secured on the three field examinations during which the flow of the river at this station was known with some degree of accuracy. These data indicate further that the river is subject to very rapid rising, due to the effect of high water and heavy rains on the watershed above Leavittsburg.

TABLE No. 10.

AVERAGE DAILY GAUGE HEIGHT AT LEAVITTSBURG, AUGUST 2, 1908, TO MAY 31, 1909.*

(Gauge readings in feet.)

1908-9.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May
1	......	0.5	0.65	1.05	1.1	1.05	2.0	3.7	2.55	13.85
2	0.9	0.85	0.65	1.05	1.05	1.0	2.3	3.2	2.45	11.9
3	1.0	0.9	0.65	1.05	1.15	1.0	2.9	3.55	2.35	5.8
4	0.95	0.8	0.4	1.0	1.1	1.15	4.2	6.15	2.3	4.2
5	0.85	1.15	0.6	1.0	1.0	1.35	4.55	4.1	2.5	3.4
6	1.3	0.65	0.6	1.05	1.1	3.2	4.2	3.45	2.7	2.95
7	2.3	0.45	0.6	1.05	1.1	3.5	3.7	3.7	6.6	2.8
8	2.2	0.7	0.7	1.15	1.2	2.7	3.2	3.2	7.05	2.7
9	1.8	0.7	0.7	1.0	1.2	2.45	2.9	2.9	4.65	2.6
10	1.35	0.7	0.75	1.05	1.15	1.9	4.5	4.5	3.9	2.5
11	1.15	0.7	0.7	1.05	1.1	1.75	4.0	4.0	3.1	2.3
12	1.0	0.7	0.7	0.95	1.0	1.7	3.5	3.5	2.6	1.8
13	0.9	0.4	0.75	0.95	1.0	1.65	3.0	3.0	2.4	1.75
14	1.1	0.7	0.7	0.95	1.1	1.95	5.7	4.1	2.4	1.95
15	0.8	0.7	0.65	0.95	1.2	1.95	9.6	3.45	2.3	2.05
16	0.85	0.7	0.7	0.95	1.6	1.65	8.8	2.9	2.3	2.55
17	0.85	0.65	0.75	0.95	2.35	1.75	4.55	2.55	2.25	2.0
18	0.9	0.65	0.7	0.95	2.15	1.9	3.55	2.35	2.35	2.1
19	0.9	0.65	0.7	0.95	1.9	1.75	3.5	2.45	2.2	2.05
20	0.8	0.4	0.7	1.0	1.7	1.7	8.45	2.85	2.05	2.05
21	1.1	0.65	0.7	1.1	1.4	2.4	9.25	4.0	1.85	1.85
22	0.65	0.65	0.7	1.1	1.1	9.0	6.65	3.4	2.05	2.3
23	0.6	0.6	0.7	1.15	1.0	9.0	6.9	2.9	2.0	2.25
24	0.8	0.6	0.7	1.05	1.0	9.5	12.7	2.5	2.0	1.8
25	0.65	0.65	0.45	1.05	1.35	7.1	14.4	2.3	2.0	2.35
26	0.65	0.65	0.65	0.9	1.2	5.15	9.3	2.65	2.0	1.5
27	0.6	0.4	0.9	0.9	1.25	4.35	5.0	5.15	2.0	2.25
28	0.6	0.8	0.9	1.05	1.2	3.9	4.3	4.25	2.35	1.55
29	0.65	0.7	1.0	1.15	1.2	2.9	......	3.4	2.8	2.1
30	0.5	0.65	1.0	1.2	1.15	2.2	......	2.95	11.1	1.7
31	0.5	......	1.0	......	1.1	2.0	......	2.65	......	1.85
Average	0.94	0.77	0.71	1.02	1.26	3.05	5.6	3.41	3.04	3.06
Maximum	2.3	1.15	1.0	1.15	2.35	9.5	14.4	6.15	11.1	13.85
Minimum	0.5	0.4	0.4	0.9	1.0	1.0	2.0	2.35	1.85	1.7

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*Data are averages of observations morning and evening.

Discharge of East and West Forks at Newton Falls.

On the first examination, current meter measurements were made on both the East and West Forks of the river at Newton Falls; the measurements were made by wading. Those on the East Fork were made before the new power dam was constructed and are representative of a moderately low flow in the river at this point. The discharge measured on July 20, 1908, was 49 second-feet or 31,600,000 gallons in twenty-four hours, and the mean velocity was 0.84 feet per second.

The discharge of the West Fork measured on the same day was 44 second-feet, or 28,500,000 gallons in twenty-four hours. The mean velocity was 0.79 feet per second. The old dam on the West Fork at Newton Falls was in use when these measurements were made.

Discharge of River Below Lowellville Dam.

On each of the three examinations, measurements of the flow of the river were made about 1,000 feet below the dam at Lowellville. No measurements appeared to be practical between Leavittsburg and Lowellville in view of the fact that the river is merely a succession of pools formed by the numerous dams between these two points. In low stages of the river its velocity at points between Leavittsburg and Lowellville is less than 0.06 foot per second.

On the first examination current meter measurements were made at Lowellville by wading the stream. The discharge on July 30, 1908, was 126 second feet, or 82,000,000 gallons in twenty-four hours. The mean velocity was 0.46 foot per second.

On the second examination, the velocity of the stream was too low to admit of the use of the current meter. Below the Lowellville dam the river separated into two channels, the flow of each of which was approximated with surface floats. The combined flow thus determined was 16.0 second-feet, or 10,300,000 gallons in twenty-four hours, and is exclusive of considerable water which passed through the gravel in the bed of the river and was not measured. The average velocity in one channel was 1.37 feet per second; in the other 0.23 foot per second On the third examination the discharge was measured by the current meter from the highway bridge at Lowellville above the dam. The river was at a moderate flood stage and there appeared to be practically no interference due to the dam. The discharge on February 19, 1909, was 2,014 second-feet, or 1,295,000,000 gallons in twenty-four hours. The mean velocity was 1.06 feet per second.

Summary.

One of the most striking features relative to the dry weather discharge of the Mahoning River is the fact that the manufactural con sumption of the river water exceeds the actual flow many times, a fact which necessitates the repeated use of the river water. As a consequence of these conditions, manufacturers have constructed numerous low dams particularly in the Youngstown district and below, with a result that the current velocity is generally very low during dry seasons. While there is at present no conservation of the flood-waters of the Mahoning River, the evergrowing consumption of water along this stream for public and industrial uses would appear to warrant attention to some plan of flood-water storage.

Referring to the discharge measurements, it is to be stated that while there is no claim for great accuracy, the data indicate especially, approximately low water conditions. Practically no attention was paid to the measurement or estimation of high water discharges.

CHARACTER OF RIVER WATER AND THE EFFECT THEREON OF POLLUTION BY SEWAGE AND MANUFACTURAL WASTES.

The character of the river water, that of the larger tributaries, the nature of certain sewage effluents and the more important manufactural wastes discharged into the stream are shown by the analytical data obtained on the three field examinations. For convenience, these data are discussed under the serial sampling stations on the main river following the flow of the stream to the state line. The results of each individual sampling station are taken up in order and in conjunction with the data for the serial sampling stations. The discussion of the character of the sewage effluents and manufactural wastes varies with that of the character of the river water in its relation thereto. Only general data are here discussed and for details reference should be made to the appendix.

Weather conditions of course affect the flow of the stream and the character of the river water as influenced by the various polluting evidences; or in other words, there is a decided variation in the river water as shown by analysis under different conditions of stream flow. The three field examinations lasted twenty, twelve, and thirteen days, respectively, and while it was not practicable to cover even a fairly large portion of the river at one time, yet save for the third field examination conditions were substantially the same during a given examination. This feature is especially fortunate with respect to the interpretation with reference to sewage and other sources of pollution of the character of the river at different points.

On the third examination, during a normal early spring flood, conditions changed somewhat from Alliance to Lowellville during the tests. There were two separate rises in the river during the examination.

FIRST FIELD EXAMINATION.

The first field examination which continued from July 14 to July 29, 1908, inclusive, was made under ordinary low water conditions which usually prevail in the river during the summer months.

Weather Conditions.

The examination began at Sebring and Alliance on the morning of July 14. There was a heavy local shower at 6:00 A. M. on July 14, but no more rain fell during the work at Alliance. Clear weather prevailed until the 17th, when at 2:00 P. M. at Newton Falls there was a heavy thunder shower which lasted about two hours. At Warren on July 21, there was a heavy local shower, and again at Niles on the afternoon of July 23 there occurred a local rain on the watersheds of both Mosquito and Meander creeks. Fair weather prevailed from this date until July 27, when at Youngstown there was a heavy local shower. During the remainder of the examination there was no rainfall.

Above Alliance.

The first sampling point on the river above Alliance was at the water works intake of Sebring. The water showed considerable turbidity, was quite hard, and contained some pollution as indicated by the presence of B. coli. This pollution presumably is to be attributed to the heavy local rain which fell early in the morning prior to the collection of the sample.

The next sampling point on the river was about 800 feet above the entrance of Fish Creek. This water was very similar in character to that just discussed. The serial sample above Alliance but below Fish Creek was similar in character to the two just discussed, but the water showed a considerable variation in bacteria and turbidity. This water would be entirely unsatisfactory as a source of supply for Alliance were it not for the storage and sedimentation afforded by the large dam and the canal which leads from the dam to the water works pumping station. The effect of sedimentation afforded by the dam and the canal is indicated by the analysis of a sample collected at the Alliance water works on the afternoon of July 15. The water was clear, contained less bacteria, but was polluted as indicated by the presence of B. coli.

Certain of this pollution is no doubt due to that introduced from the several creeks and storm sewers located in East Alliance, as is more clearly shown from the data obtained on the subsequent examinations.

Of considerable interest and importance with reference to the pollution of the Mahoning River above Alliance and its effect upon the Alliance water supply is the sewage from the village of Sebring.

Sulphur Creek and Sebring Sewage. A special investigation was made of the character of Sulphur Creek water and the effect thereon of the raw Sebring sewage. Samples were collected of Sulphur Creek water above the confluence with the sewage, of Sebring crude sewage, and Sulphur Creek at three points below its confluence with Sebring sewage. The results of these analyses show the actual influence of the sewage of Sebring upon the Mahoning River water above Alliance under conditions which prevailed during this first examination.

The volume of Sulphur Creek was about 50,000 gallons in twenty-four hours; that of the Sebring sewage about 62,000 gallons in twenty-four hours. Sulphur Creek water is a hard, acid mine water, and when admixed with the Sebring sewage under the above volume relations, within 150 feet of their confluence the sewage is very thoroughly coagulated. One mile below this point the water of the creek is clear and colorless, and practically without odor. On the bottom of the bed is a mobile deposit of black sludge colored brownish red on the surface due to the oxidation of the iron. As the analyses clearly indicate, this acid water removes from the Sebring sewage a very substantial percentage of the organic matter. It markedly reduces the bacteria, but even then Sulphur Creek water to within about a mile of its confluence with the Mahoning River through Fish Creek is distinctly polluted as shown by the presence of B. coli. It is apparent that during high water and local rains, this precipitated sewagic material is washed directly into the Mahoning River and thus may have some effect upon the Alliance water supply by increasing the pollution of the water prior to its sedimentation.

Below Alliance to Newton Falls.

About one-fourth mile below the city water works, the effluent from the chemically treated sewage at Alliance discharges into the Mahoning River. At this examination there was a riffle immediately above the sewer outlet and below a shallow pond perhaps 500 feet in length, in which the sewage was fairly well mixed with the river water. The Alliance sewage which for a number of years has been treated with lime and then settled, is still putrescent, grossly pollutes the Mahoning River, and during the summer months, as was noted on this examination, causes the river to become a marked public nuisance. The flow of the river was small, as before noted, and the dilution available low. In the pool immediately below the sewage outfall, there was perhaps a foot of black sludge and an abundant development of gas, conditions similar to those which obtain in a well seasoned septic tank. The chemical and bacterial data indicate strongly the very decided pollution caused by the Alliance sewage.

Continuing down the river toward Newton Falls, samples collected at 3½, 6, and 8 miles below Alliance showed rapid and marked improvement. Even at the station 3½ miles below Alliance the river was foul as indicated by deposits and by the appearance of the banks. Similar pollution was noted at the station 6 miles below Alliance. At the third station, about one mile from Deerfield, the river was much cleaner, the banks were in good condition and all visible evidences of pollution by the Alliance sewage had disappeared. In fact, on this examination at this point, 8 miles below Alliance, the bacterial analyses of the water were practically the same as above Alliance, but the turbidity was much less. The destruction of bacteria in the flow of the river from Alliance to this point is no doubt largely influenced by the numerous dams and riffles found at low stages. It is of interest to note the decrease in the alkalinity in the river water below Alliance as compared with that of the stations above Alliance.

Newton Falls, East and West Forks, and River Below Confluence.

Upon reaching Newton Falls the water in the east fork of the river shows practically no visible evidence of the pollution it has received at Alliance. The bacterial data did not differ materially from those obtained on the sample collected 8 miles below Alliance. It is of interest again to note the decrease of alkalinity. On this examination the station on the east fork of the river at Newton Falls was a serial station. The effect of the heavy rain on the afternoon of July 17 is seen in the marked increase in bacteria and in turbidity.

The west fork of the river which enters a short distance below Newton Falls, was also a serial station on this examination. Owing to the effect of rain on its watershed, the numbers of bacteria and the turbidity were very much greater than true of the east fork of the river. The alkalinity of the water was very much less than that from the east fork, presumably in part due to the effect of local rains.

Below the confluence of the east and west forks of the river the water was practically the average of that in the two forks, although of course influenced somewhat by the effect of the rain which was localized at Newton Falls on the afternoon of the 17th. It is evident from the results that local rains introduce considerable pollution, most of which presumably is of rural origin, as practically no sewage nor manufactural wastes enter the river at Newton Falls. A small creamery on the east bank of the river discharges some wastes from churns, but its volume is probably too insignificant to have a marked effect upon the quality of the river water.

Eagle Creek.

There were collected single samples of the Eagle Creek water and that of the Mahoning River below the entrance of the creek. Owing to the effect of local rains, Eagle Creek showed some evidences of pollution. Its water was distinctly softer than the river at Newton Falls and the turbidity was higher.

Warren Water Works Intake.

The next serial station was at the intake of the Warren water works. Samples collected covered practically a twenty-four hour period. The river at this station carries considerable pollution as indicated by the total numbers of bacteria and by the presence of B. coli. The water is noticeably softer than at points above. The data indicate the effect of the local shower at Warren, as shown by the increase in total bacteria and in coli. Previous studies of the water at the intake of the Warren water works strongly indicate that local showers have a marked effect as regards the bacterial character of the river water.

Under fairly low flow conditions, of course, considerable clarification is afforded by the Warren water works dam which affords a maximum depth of water of about 6 feet and causes it to pond for a distance of about 3 miles. The analytical data further indicate that there is no large constant pollution at this point, as shown by the fact that with the subsidence of the water the quality rapidly improves.

Trumbull County Infirmary and Young's Run. Several years ago there was considerable apprehension in Warren with reference to the pollution of the Mahoning River by the sewage from the Trumbull County Infirmary, which was at that time discharging untreated sewage into Young's Run. As a result of this agitation, in 1899 a sewage purification plant was installed at the infirmary. It consists of a pumping plant. a septic tank, storage reservoir, and two filters constructed of crushed cinders and operated as intermittent filters. As the analyses of the effluent indicate, during this field examination the plant was affording a very highly purified effluent. To be sure it contained very large numbers of bacteria and B. coli, but facilities for purification and the effect of the dilution in Young's Run were such that the water in the run, from the analysis of a sample collected perhaps half a mile above the point at which it enters the Mahoning River, contained no more bacteria and was thus no more polluted than samples of the Mahoning River collected at the Warren water works intake. The purified sewage from the Trumbull County Infirmary, therefore, is practically of no significance with reference to the pollution of the Mahoning River immediately above Warren.

Below Warren Sewer Outfalls.

The sampling station below the Warren sewers was near the east bank of the stream and in the full current of a riffle. At this point the sewage and the river water appeared to be thoroughly mixed. The analyses indicate the marked pollution of the river as shown by the total bacteria and the large numbers of B. coli. The series of samples here collected also indicates the variation in the effect of the sewage during roughly twenty-four hours. The effect of the sharp local shower at

Warren is very apparent from the very great increase in the turbidity. Although the greater dilution then available of course in a measure offsets the effect of the sewage. The sewage caused a considerable reduction of the dissolved oxygen of the river water, which had a noticeable odor of fresh sewage, and in general was very grossly polluted by the Warren sewage.

Above Niles.

The serial sampling station above Niles was about 20 feet from shore at a point where the river is about 150 feet wide and about 5 feet deep and with approximately an even velocity. The results of the analyses indicate a striking variation both in the chemical and bacterial quality of the water. The turbidity, total bacteria, and coli were subject to very extensive variations. Presumably these marked changes were due to the local rain on the watershed above Niles. The data appended clearly indicate the effect of the Warren sewage. In general the water is grossly polluted and in a raw state was entirely unfit for domestic consumption.

Below Niles at Erie Railroad Bridge.

To learn the effect of the Niles sewage, there was established a serial station at the Erie Railroad bridge about one mile below Niles. The analytical data show similar variations to those found at the station above Niles, but the various determinations show a less range, possibly due to the effect of the Girard dam, the backwater from which extends a considerable distance above Niles. It is interesting to note the continued decrease in the alkalinity as the examination was continued farther down the river. The decrease below Niles is presumably to be attributed to the soft water from Mosquito Creek. The data at this station indicate that the Niles sewage at that time did not have a very marked effect upon the pollution of the river.

Mosquito Creek. At Niles, there was collected a sample from Mosquito Creek at a point above all sources of pollution from the city. Although the water contained B. coli, the stream was evidently not receiving any appreciable pollution. Its turbidity and alkalinity were very much lower than true of the Mahoning River at Niles.

Meander Creek. A sample of the Meander Creek water showed even less pollution than that from Mosquito Creek. The turbidity of the stream was very high compared to the river, due to local rains. The water is much harder than that of Mosquito Creek and it is also much less highly colored.

Below Girard.

The serial sampling station below Girard was about three-fourths mile below the center of the village opposite the Girard Furnace Company. Below the railroad bridge there is a dam in the river about one-fourth mile above the sampling point, and this raises the water level approximately 10 feet and affords considerable opportunity for sedimentation. The analytical data indicate a continued high bacterial content, much higher in fact than found either above or below Niles. At this station the alkalinity was lower. The effect of the dam is evident in the reduction of the turbidity. The absence of fluctuations in the numbers of bacteria and coli indicates that there is but little increase in pollution between Niles and Girard.

Briar Hill.

The sampling station at Briar Hill above Youngstown was located about 300 feet above the Briar Hill bridge and above all sources of pollution from the city. The stream was probably 300 feet wide at the station and had a muddy bottom. The water is fairly stagnant at this point due to a dam about 1300 feet below.

The river water at this point was well aerated and fairly soft. During the twenty-four hours covered by the sampling, the turbidity was decreasing. In general, the water was in much better condition than true at the station below Girard, indicating that but little important pollution was entering the river between these two points during the period these samples were collected.

Intake Youngstown Water Purification Plant.

Samples of raw water were collected from a sampling pump at the laboratory of the Youngstown water plant. About 500 feet above the intake is a small dam about 3 feet high, and in fact there are several such dams between Briar Hill and the Youngstown water works. At the water works the river is about 200 feet wide and has a maximum depth of about 8 feet. The bottom is of mud approximately 4 or 5 inches in depth. About 200 feet above this station and on the opposite side of the river is discharged the cooling water used in the lower mill of the Ohio Steel Company. Considerable grease, oil, and ore dust were noted on the river.

The results of the examination are most interesting as indicating a very serious and dangerous pollution of the raw water at the Youngstown filter plant, due to surface washings which follow a heavy shower. As the results indicate, the heavy shower in the forenoon of July 27 caused a very rapid run-off of the filth which accumulates in the unsewered portion of Youngstown. The effect of the pollution introduced into the river from this unsewered section of the city is strikingly apparent when the analytical data of the Youngstown water works are compared with those obtained at the Briar Hill station. The samples at Briar Hill show no such variation as found at the Youngstown water works intake, and indicate that at this examination the effect of the sewage poured into the river above Youngstown was not marked.

Ohio Steel Company's Wastes from Upper and Lower Mills. Two large outfalls, one each from the two plants of the Ohio Steel Company, each of which pumps daily about 35,000,000 gallons of water from the river, discharge a short distance above the Youngstown water works intake. The water withdrawn from the river in such enormous volumes is returned above the shallow dams erected by the company and is used again and again. The wastes have a comparatively high temperature, which during this examination was found to be 110 degrees Fahr. They have an oily smell and cause a heavy black deposit on the bed of the stream. On investigation this deposit was found to vary from 0 to 18 inches in depth and to be largely organic in character, similar to that found in streams below sewer outfalls. It also contained considerable graphite. The high temperature of these wastes is sufficient to raise the temperature of the river water ten degrees. It is stated that the temperature of the river water has been noted as high as 120 degrees Fahr. The wastes from both of these plants carry some sanitary drainage, as indicated by the bacterial analyses. Apparently, the fact that the water pumped from the river is materially raised in temperature does not markedly destroy the bacteria.

Mill Creek. During this examination samples were collected of the water from Mill Creek. As the analyses indicate, the water was only moderately polluted.

Crab Creek. Crab Creek in Youngstown receives the greater part of the sewage from the city sewers and other manufacturing establishments. At its mouth is the main sewer of the city. The very gross pollution of this small stream is apparent from a study of the analytical data. It is noticeable that the water was but slightly oxygenated. The entrance of sewage was further shown by the increase in alkalinity over that of the river water.

Below Haselton Bridge.

About 900 feet below Haselton bridge there was established a serial sampling station at which samples were collected for approximately 24 hours. Above this point on the river is discharged all of the sewage from the city of Youngstown. The effect of the city sewage and wastes from the various manufacturing industries is most marked. As the analyses show, the river was very grossly polluted and contained as many bacteria as ordinarily found in weak sewage. Owing to the effect of the water used by the Republic Mills for cooling, the temperature of the river was quite high. The dissolved oxygen results further suggest the extent of the pollution by sewage. There was considerable variation in the character of the river water at this station, presumably due to the effect of a local shower. Of special interest is the large increase in turbidity and total bacteria.

Above Struthers.

The station at Struthers is about 500 feet above the Struthers highway bridge and directly opposite the plant of the Struthers Furnace Company. The water was quite deep as it was ponded for some distance by the Struthers dam. The bottom of the stream was covered with a slimy, yellow deposit, presumably largely ore dust, precipitated iron waste, and some algal growths. The analyses strikingly indicate the marked improvement in the river water as compared to the results obtained below Haselton bridge. This fact presumably due to two factors, namely, the introduction of considerable quantities of acid iron wastes from the plant of the Youngstown Sheet & Tube Company, and the sedimentation afforded by the Struthers dam. The acid iron wastes reduced the alkalinity and, together with the sewage, withdrew the oxygen from the stream. The results of the laboratory analyses strikingly indicate the marked increase in iron. In general, the river was very much improved as compared to its condition below Haselton bridge.

Main Drain Youngstown Sheet & Tube Company. A sample collected during the study of the river at Struthers from the main drain of the Youngstown Sheet & Tube Company's plant indicates the general character of the cooling water discharged from this plant. This water consisted of sanitary wastes and cooling water from the cupolas, was of very high temperature, and contained much smaller numbers of bacteria than found in the river water, possibly due to some germicidal effect of the high temperature to which it is subjected. Apparently these wastes did not contain a very large quantity of iron.

Drain from Struthers Furnace Company. A sample collected from the main drain of the Struthers Furnace Company indicated a water of a character similar to that noted in the case of the other wastes from the steel mills. Owing to the heating effect presumably, the water contained fewer bacteria than the river water just above the intake of the pumps. The high temperature of this waste is especially to be noted. The analyses indicate that it contained considerable iron.

Below Struthers.

The sampling station at Struthers was at a point 1200 feet below the Struthers highway bridge and about 300 feet below the entrance of Yellow Creek. The water at this station was slightly less polluted than that above Struthers, indicating the effect of the storage afforded by the Struthers dam and suggesting that comparatively little pollution was entering the river from the village.

Yellow Creek. A sample of water was collected from near the mouth of Yellow Creek which received the drainage from the rod and wire mill of the Youngstown Sheet & Tube Company, particularly acid iron wastes. As the analyses indicate, the water is markedly affected by these wastes. The alkalinity and dissolved oxygen were very low and the iron very high. Some pollution was indicated, presumably due to sanitary sewage from the mill. The effect of the Yellow Creek water upon the Mahoning River is a marked reddish coloration. The bed of the river at the mouth of Yellow Creek was stained red and the waters of the river are noticeably reddened for about one-third of the distance to Lowellville.

Three Hundred Feet Below Lowellville Dam.

The last station on the river was at a point 300 feet below the Lowellville dam. This dam raises the level of the water about 10 feet and forms a pond which extends toward Struthers for a distance of almost three miles. At the sampling station the river was approximately 300 feet wide and had a gravelly bottom. There was a noticeable odor in the river water, indicating some pollution. The bacterial data indicate a polluted water but show that in the flow of the river from Struthers to Lowellville the effect of sedimentation aided by the acid iron wastes introduced above Struthers and at Yellow Creek was merely to clarify the water. The turbidity at this station was very much less than at the station below Struthers. The river water contained considerably more oxygen than found below Struthers, presumably due to the river flow over the Lowellville dam. The sedimentation afforded between Struthers and Lowellville is very forcibly indicated by the decreased quantity of iron.

SECOND FIELD EXAMINATION.

The second field examination continued from September 29, 1908, to October 9, 1908.

Weather Conditions.

This examination was made under exceptionally dry weather conditions and in many instances the river was said to have been lower than ever before known. At Sebring and at Alliance there was a slight shower the day previous to the collection of samples. No rain fell until Warren was reached, when there was a light rain on the day previous to the collection of samples. For the remainder of the examination the weather continued clear.

In general the sampling stations were the same as those in use on the first examination. The serial stations near Newton Falls were, however, omitted. Samples were collected from all tributaries not examined on the first examination together with additional samples of noteworthy manufactural wastes.

Above Alliance.

The first sample collected from the river was above Alliance at the water works pumping station of Sebring. The water was very hard and of low turbidity, although there was a light rain the day previous to the collection of the sample. Some slight pollution was again noted at this station as indicated by the bacterial data.

At the serial sampling station above Alliance but two samples were collected. The river was practically three feet lower than during the first examination. The turbidity of the water and the total numbers of bacteria were higher than found on the first examination, due presumably to the rain of the day previous. The marked increase in the hardness of the water as shown by the alkalinity is especially noteworthy. The effect of the impounding of this water is noted from the analysis of a sample collected from a tap in the city of Alliance. The turbidity was reduced about 50 per cent, but was much higher than is desirable for a public water supply. Owing to the extreme dry weather conditions, many of the sources of pollution above Alliance were removed. Of special interest in this connection is the effect of the Sebring sewage upon the water in the Mahoning River above Alliance.

Sulphur Creek and Sebring Sewage. The investigation of conditions at Sebring was repeated on the second examination. The flow of Sulphur Creek was found to be 28,000 gallons in twenty-four hours, and that of the Sebring sewage 46,000 gallons in twenty-four hours.

The Sulphur Creek water was acid, clear and colorless, and free from dissolved oxygen, and was practically non-polluted. The marked coagulation effected where the waters from Sulphur Creek mingle with the Sebring sewage was again noted. One mile below the confluence of the two streams the supernatant liquid was clear, but on the bed of the stream there was noted from 6 to 8 inches of black sludge superficially coated with red oxide of iron. The water at this point contained no dissolved oxygen and showed a marked decrease in bacteria. Two and one-half miles below the confluence of Sulphur Creek and the Sebring sewage, additional acid water was entering the creek. There was practically no evidence of pollution and the muddy bottom when stirred up showed very little sludge. The general evidence on this second examination indicates that during this extremely dry period the untreated sewage of Sebring is so changed before it reaches the Mahoning River above Alliance as to be of practically no marked significance with reference to the potability of the Alliance water supply. The masses of sludge in Sulphur Creek below its confluence with the Sebring sewage suggest that this material, which no doubt contains large numbers of bacteria and B. coli, will tend to have a decidedly harmful effect on the water in the Mahoning River above the Alliance dam as soon as there is sufficient rain to flush the channel of the creek, although of course, the dilution available at such times is very large.

The small creek which receives the drainage from the so-called cellar drains of Sebring, was again examined. The analyses show a well aerated water but polluted, as indicated by the total bacteria and B. coli. The flow at this station was very slight and heavy algal growths and some sludge deposits indicated the effect of the pollution introduced into the stream by the drainage from the cellar drain sewers of Sebring. The flow of this stream, however, was so small as to be practically of no marked significance with reference to the general pollution of the Mahoning River above Alliance.

Below Alliance to Newton Falls.

Below Alliance the pollution of the river was strikingly indicated by the marked reduction in dissolved oxygen, the presence of organic matter as indicated by the free ammonia, and the enormous numbers of bacteria. The river water was very much harder than above Alliance, and the water had a very decided odor of sewage.

From Alliance to Deerfield there were collected four samples at stations 3½, 6, 11, and 17 miles respectively, below the Alliance sewer outfall. In the samples at 3½ and 6 miles below, there was ample evidence of the gross pollution of the river as indicated by the black color and decided sewage odor, particularly at the first station. It is interesting to note the marked decrease in total numbers of bacteria as the river flows downstream, and also the absence of dissolved oxygen on the first and second samples.

A sample was collected at Pricetown, about 17 miles below Alliance. The river was very low and the bed of the stream was dry in many places. Practically no local pollution enters the stream at this point. Aside from the presence of B. coli there was but little evidence of the pollution which the river received at Alliance. It is interesting to note the marked reduction of alkalinity at this station as compared with that of the water at Alliance. In general, the analyses indicated that the visible pollution from Alliance may be traced for eight miles, but that it practically disappears between eight and eleven miles. The bacterial pollution was apparent even seventeen miles from Alliance at Pricetown, but presumably this pollution as indicated by the coli was not greater than found in such surface streams from rural districts as Kale Creek which enters the Mahoning River a short distance below Pricetown.

Kale Creek. A sample was collected from Kale Creek, a small tributary of the Mahoning River. The flow of the creek was very slight. On analysis the water was found to show some pollution, presumably chiefly of rural origin, and to be very much harder than that in the Mahoning River.

Newton Falls, East and West Forks, and River Below Confluence.

A single sample was collected from the east and west forks of the Mahoning River at Newton Falls and from a point below the confluence of these two branches of the river. The results of these analyses indicate the character of the river to be similar to that noted at Pricetown. The water was well oxygenated, contained but relatively small numbers of bacteria and coli, and indicated practically none of the pollution which enters the river at Alliance. It is interesting to note the continued reduction in alkalinity, indicating that softer waters enter the Mahoning River as it flows from source to the state line.

Below Eagle Creek.

The sample collected from the main river below Eagle Creek indicated a water similar in character to that on the main river below Newton Falls.

Warren Water Works Intake.

At the serial sampling station at the intake of the Warren filter plant the river water was clear but harder than ever found previously. During the twenty-four hours of the test there was a slight improvement in the character of the river water owing to the subsidence of the stream following a light rain on October 2.

Trumbull County Infirmary and Young's Run. Conditions at the sewage purification plant of the Trumbull County Infirmary were substantially the same as on the first examination. Again the analyses indicated a highly purified sewage effluent. The bacterial quality of the effluent was not so high as on the first examination. Young's Run, which receives the filtered sewage, was practically dry at the sampling station. The run was fed almost entirely by springs and this fact was indicated by the very high alkalinity and free carbonic acid. The water was clear and well aerated but contained considerable bacteria and some coli. Possibly this pollution may in part be derived from neighboring residences. By comparing the analytical data for Young's Run with those for the Mahoning River above Warren, it is evident that when these samples were collected, Young's Run did not measurably increase the organic pollution of the river nor did the bacteria introduced by the run exceed those normally present in the Mahoning River above Warren.

Below Warren Sewer Outfalls.

At the station below Warren, the river was very low and it was necessary to wade the stream to collect satisfactory samples. As the analyses indicate, the river at this time was grossly polluted by the Warren sewers. The water had a decided sewage odor. The large numbers of coli are of special interest and significance. During the twenty-four hours covered by the sampling, the variation in the character of the river water was not marked.

Above Niles.

At the serial sampling station on the river above Niles, similar fluctuations were observed in the quality of the water as noted on the first examination. Especially is this true of the total numbers of bacteria and B. coli. This fact may be attributed to the location of this station but a few miles below Warren, especially since the fluctuations in the bacterial counts above Niles correspond roughly to the varying volume of Warren sewage, particularly during the day and night periods. Owing to the much lower flow in the river, the river water was much harder than was found on the first examination.

Below Niles, at Erie Railroad Bridge.

At this station there was practically no flow and in fact the current appeared to be upstream. There was a heavy scum over the entire surface of the water. The analyses indicate the continued pollution of the river and suggest the effect of the Niles sewage. The water was slightly less oxygenated and contained on an average more total bacteria than found at the sampling station above Niles.

Mosquito Creek. The flow of Mosquito Creek was very slight. The analysis of the sample collected indicated considerable pollution. It is noticeable that this water is much softer than that in the Mahoning River. Inspection indicated the gross pollution of Mosquito Creek in Niles below the dam, caused by the discharge of several of the Niles sewers. The sampling station was above this source of pollution.

Meander Creek. A sample collected from Meander Creek showed decidedly less pollution than that from Mosquito Creek. The water was clear and well aerated. It is to be noted that Meander Creek enters the Mahoning River below the sampling station at the Erie Railroad bridge at Niles.

Below Girard.

Since the previous investigation had indicated but little variation at the station below Girard, but two samples were collected at this point. The analyses indicate a great reduction in bacteria as compared to these data below Niles, and also a marked reduction in alkalinity. These conditions are to be attributed to the effect of the acid iron wastes which enter the stream within and below Niles, and to the sedimentation afforded by the Girard dam. The improvement of the water below the Girard dam on this examination as compared to its condition below Niles, refers also to the organic matter as indicated by the oxygen consumed. The marked increase in chlorine at Girard is presumably due to the muriatic acid used in the iron manufacturing establishments above this point.

Briar Hill.

The river water at Briar Hill on this examination was very clear, although there was a deposit of slime on the bottom of the stream. There was a slight rainfall on the evening of October 8, but insufficient to affect the flow of the stream. The analyses of the river water are very interesting and suggestive, since they show a marked improvement in the river water between Girard and Briar Hill. Opportunities for self-purification, especially sedimentation, are no doubt the underlying causes of these changes. There was some variation in the quality of the water from both a chemical and bacterial standpoint. Possibly this is to be attributed to variations in the volume of acid iron wastes discharged above Girard.

Youngstown Water Works.

Samples of the river water collected at the Youngstown filter plant showed a much more polluted and turbid water than that at Briar Hill. There was a marked improvement, however, in the character of the water on the second day of the examination. Owing to the very low stage of the river, which was merely a succession of shallow pools, the raw water at the filter plant was more greatly influenced by the wastes from the mills of the Ohio Steel Company. In general, the water was of very much better quality than found on the previous examination, during which there fell a heavy local rain.

Wastes from the Ohio Steel Company's Mills. At the low stage of the river during this examination the effect of the use of the river water for cooling and for the disposal of wastes from the two mills of the Ohio Steel Company, a short distance above the Youngstown water works intake, is most marked. Two samples were collected, one from the drain of the upper mill located about 400 feet above the intake of the filter plant, and one from the drain of the lower mill situated almost directly opposite the intake. It is interesting to note the large numbers of B. coli in the sample from the drain of the upper mill. This sample was of foul appearance and contained large quantities of black suspended matter, presumably graphite. The wastes from the lower mill were also unsightly in appearance and had a decided odor. While the total number of bacteria was high, coli were absent in 0.1 cubic centimeter. There was a considerable reduction in dissolved oxygen as compared with the river water, especially in the sample from the lower mill. These wastes have a very decided oily odor which is oftentimes noted in the raw water at the Youngstown filter plant. It is apparent that these wastes in view of their character and very large volume, had a marked effect upon the quality of the water at the intake of the Youngstown water works plant. It is of interest to note the increase in temperature in the river water between Briar Hill and the Youngstown water works. This fact is explained by the high temperature of the enormous volumes of water used by the various steel plants situated along the river between these two stations.

Crab Creek. A sample collected at Crab Creek on this examination showed that the creek flow was practically entirely domestic sewage, possibly admixed with some iron wastes indicated by the yellowish color of the water. The sample had a very foul odor and was distinctly putrescent. It contained no dissolved oxygen, very large numbers of bacteria and B. coli, and was of high turbidity. Just above this station the main 72-inch sewer of Youngstown enters Crab Creek. During this period of dry weather, presumably the ground water leakage was very low and the flow was almost purely domestic sewage. The outlet of the creek in the Mahoning River was an unsightly bed of foul, black, slimy sludge.

The pollution of the Mahoning River by the Youngstown sewage during this exceptionally dry period was decidedly pronounced; in fact, at the sampling station below Haselton the river was practically a weak sewage.

Below Haselton Bridge.

During this examination the river flow did not exceed possibly 15,000,000 gallons and thus not more than 7,000,000 to 7,500,000 gallons daily flowed past the Youngstown water works intake. The quantity of water available for the dilution of the Youngstown sewage was thus very small, and the effect of these low water conditions in the river was very marked at the stations below the Haselton bridge. The flow of the river was practically Youngstown sewage used repeatedly by the many steel plants along the river between the water works and Haselton bridge and thereby heated to an average temperature of 85 degrees Fahr. The river water emitted considerable odor, the banks were noticeably foul, and the bed of the stream and the shores were covered with luxuriant growths of sewage algae. The hardness of the water was noticeably greater than at Briar Hill, presumably due to the effect of the Youngstown sewage. Due to the combined effect of sewage and ore dust, the turbidity of the river was about twenty times that above Youngstown. It is of special interest to note that no dissolved oxygen whatever was found in any of the four samples examined. The field bacterial data and as well the laboratory analyses for organic matter strikingly indicate the enormous pollution of the river and bring out the fact that the river water was substantially but slightly diluted Youngstown sewage. In all but one sample the total numbers of bacteria exceeded 1,000,000, and coli were present to the extent of 2000 per cubic centimeter.

Above Struthers.

The station at Struthers was on the north side of the river about 600 feet above the Struthers dam. The river flow was so slight that the dam, practically formed a large, stagnant pool, from which the Struthers Furnace Company was pumping about five or six times the flow of the river, with the result that the temperature of the water was raised to from 91 to 94 degrees Fahr. The marked effect of the acid iron wastes from the Youngstown Sheet & Tube Company's large plant at East Youngstown was very noticeable at this station. There was a marked coagulation noted in the river, and along the banks there was observed heavy deposits of ferric oxide and organic matter. The entire bed of the stream appeared to be coated with a slimy deposit of a reddish color on the upper surface but tarry black beneath. The analyses indicated a great improvement over the character of the river water at the station at Haselton bridge. The effect of the acid iron wastes introduced from the Youngstown Sheet & Tube Company's plant was most marked. Their presence is shown by practically a 50 per cent reduction in alkalinity; further, by an increase in the acidity to phenolphthalein. Although entirely void of dissolved oxygen at Haselton bridge, the water at this station contained considerable oxygen, suggesting the catalytic influence of the iron. The bacterial data are especially suggestive as indicating the beneficial effect of the coagulation afforded by these acid iron wastes and the sedimentation obtained above the Struthers dam, causing a marked reduction in total numbers of bacteria and also in B. coli. Of course, as the data suggest, the analyses of the acid iron wastes are somewhat irregular, especially since it is usually the practice to discharge the spent pickle vats only at occasional intervals. In general, the river was very much improved at Struthers and the effect of the Youngstown sewage was not nearly so marked as at Haselton bridge. This improvement is caused by what is really chemical treatment and sedimentation and it is apparent that this process entails the production of considerable organic sludge which is here deposited upon the bottom of the river, and which with the advent of high water will be scoured out and carried downstream.

Drain from Struthers Furnace Company. A sample of the waste water discharged from the Struthers Furnace Company on analysis showed results similar to those obtained on the first examination. The water was discharged at a high temperature and this heating possibly destroyed some bacteria, as indicated by the fewer numbers of bacteria in these wastes as compared to the water in the river which is pumped over and over again for use in the plant.

Wastes from Youngstown Sheet & Tube Company. Analyses of the three samples of the different wastes discharged from the plant of the Youngstown Sheet & Tube Company suggest the general character of these wastes, especially the presence of acid iron liquors which, as above mentioned, have such a marked effect upon the river water at the Struthers dam. The considerable pollution of these wastes is indicated by the bacterial data. The wastes from the puddle mill, which at this time received a considerable part of the acid pickling liquors, showed much less pollution from organic matter. The effect of the acid iron wastes is noted in the turbidity and alkalinity. When there is considered the enormous volumes of the wastes from this plant and the large quantity of acid used for pickling purposes, it is apparent that their effect upon the river water, particularly at such low stages as prevailed on this examination, must be very great, as has been found to be the case.

Below Struthers.

Similar conditions prevailed below Struthers as on the first examination with respect to acid iron wastes. The river was very low and the exposed banks were covered with a fairly well oxidized iron sludge. The iron appeared to be well coagulated and the river water contained coarse flocs of ferric hydroxide. But a small flow was noted in Yellow Creek and this carried considerable acid iron wastes from the sheet mill of the Youngstown Sheet & Tube Company. The effect of these acid iron wastes is noted by the considerable reduction in alkalinity and also in dissolved oxygen. The temperature of the water was slightly lower than above the dam.

Bacterially, the water contained less organisms than found above the Struthers dam, and in general the analytical data indicated the increasing effect of sedimentation and coagulation.

Below Lowellville.

Below the dam in Lowellville, with a total flow of only about 10,000,000 gallons in twenty-four hours roughly estimated from float measurements and exclusive of that which passed through the gravel in the bed of the river, the appearance of the water and the results of analyses indicated a remarkable purification taking place in the stretch from Struthers to Lowellville. The water was fairly well oxygenated and its temperature was about 22 degrees less than at Struthers. The water contained very much less numbers of bacteria. Some pollution evidently was reaching the river above this station and below Struthers, as indicated by a slight increase in coli.

Under the low flow conditions which prevailed on this examination, opportunities for sedimentation and the coagulating influence of the acid iron wastes were at a maximum. The great improvement in the character of the river water at Lowellville as compared successively to that below and above Struthers and at Haselton, is very remarkable and is worthy of special attention as indicating the self-purifying powers of the stream, as will be discussed presently.

THIRD FIELD EXAMINATION.

The third examination lasted from February 8 to 20, 1909, and was made during a normal early spring flood. The temperature of the water was low and the water was practically saturated with oxygen. Beginning at Alliance, the river was only of moderate height, but shortly after the examination began a heavy rainfall and snowfall, causing a very rapid rise; in fact, the first large rise since the long drought in the fall of 1908. On account of the high water, no samples were collected at Sebring and but few samples of manufactural wastes.

Weather Conditions.

Beginning February 8, at Alliance there fell about 1½ inches of snow and rain. The river was rising rapidly and its turbidity increasing. Rain fell all day February 9. The weather on February 10 was cold with occasional snow flurries. Fair weather prevailed on February 11 and the river was rapidly rising, reaching a maximum at about 5:00 P. M. Fair weather prevailed on the morning of the 12th, but a slight rain fell in the evening. February 13 was fair. On February 14 there was a very heavy rain which caused the river to rise rapidly. Rain and snow flurries continued on February 15 and 16 and caused a second rise in the river which reached a normal high water on the morning of February 16th. On the 17th the weather was cloudy with slight showers and snow flurries. The river was falling slightly. On February 18 and 19 the weather was cloudy and the river was still falling gradually. On February 20 considerable rain fell in the morning.

During this examination, therefore, there were two distinct rises in the river.

Above Alliance.

But one sample was collected from the Mahoning River above Alliance and at the same point used as a serial station on previous examinations. The river was about 50 feet wide and the current was sluggish. The run-off of the melting snow which fell on the previous night was considerable and the river was rapidly rising and becoming more turbid. The analyses indicate considerable numbers of bacteria, although but few coli were present.

In the afternoon subsequent to a considerable rise in the river, a sample was collected at the inlet of the Alliance water works canal immediately below the dam. The analysis showed a water similar in its physical condition to that of the station above collected in the morning, with the exception that the turbidity had increased. Owing to the effect of the sedimentation afforded by the dam, the numbers of bacteria were considerably reduced over those found in the station above Alliance; B. coli, however, were present in greater numbers than at the station above, and in general the water was polluted and not satisfactory for a domestic supply. As previously mentioned, a part of the pollution of the Mahoning River above Alliance is derived from storm sewers and brooks which enter the river above the Alliance water works dam. On this examination, samples were collected from two of these sources of pollution.

Run on Patterson's Road. This small stream evidently receives some pollution from surface washings and possibly some sanitary wastes as indicated by the analysis.

Trail's Run. One of the more important sources of pollution of the Alliance water supply is derived from Trail's Run which discharges into the river about one-half mile above the Alliance dam. When examined, the stream was oily and very black from street washing. Compared to large flow of river water at this time, the foul water of Trail's Run did not apparently have a very large effect upon the character of the river water, although the organic character of the water and its high bacterial content no doubt had some effect in increasing the impurities in the river water. The analyses indicate a weak sewage and it is probably true that this run directly receives some sanitary sewage, although washings from streets and leachings from the comparatively large area drained by this run would possibly in part account for the polluted character of this water.

Below Alliance.

Samples were again collected at the serial station below the Alliance sewage outfalls. Conditions changed materially at this station in view of the rapid rise in the river. The analyses indicate a grossly polluted water, but the conditions were by no means so pronounced as prevailed during the second examination. The effect of the dilution afforded by the rising river is indicated by the marked decrease in alkalinity. The river water at this point was well oxygenated but was not saturated. During the sampling, the bacterial quality of the river showed considerable variation as naturally would be expected. All of the samples had a faint sewage odor. In two instance the water in the river was alkaline to phenolphthalein, attributable to the effect of the lime used on the Alliance sewage.

The analyses of the Alliance sewage effluent collected simultaneously with those of the river, showed practically agreement with those of the river water, suggesting the fact that during storms the volume of flow of the Alliance sewage is very largely increased both on account of leakage of ground water and the entrance of roof water. At this examination, evidence of the marked public nuisance which prevails at this point during dry weather was absent.

Alliance to Newton Falls.

Again on this examination, samples were collected at different points below Alliance, namely, 3, 4½, 6, and 8 miles below Alliance. All samples were collected by wading into the stream at points of comparatively high velocity. Owing to the rise in the river, there were few ponds noted. The current velocity was high, which accounts for the general similarity in the physical character of the water at these different stations. As the analyses indicate, there was no marked difference in the bacterial content of the river water from the station below Alliance to that at Deerfield, 8 miles from Alliance. All of the samples were well oxygenated.

Newton Falls to Warren.

Two individual samples were collected at Newton Falls, namely, on the east and west forks of the river, respectively. The water was practically at freezing temperature. That in the west fork was more turbid and harder than that in the east fork, but the bacterial analyses from the two branches of the river were practically the same. The total bacteria were slightly higher than found on the previous day at Deerfield, possibly in part explained by the rapidly rising river.

Warren Water Works Intake.

A serial sampling station was maintained at Warren during the examination of the Warren filter plant on February 11 and 12. Owing to the heavy rainfall on the two days previous, the river was rising rapidly and reached its maximum height about 5:00 A. M., February 11.

The turbidity determinations indicate maximum suspended matter on the evening of February 11, subsequent to which the river was clearing up. The alkalinity was very low and practically constant on February 11. As the river subsided the alkalinity increased slightly. The bacterial content was practically constant on the first day but was considerably greater on the morning of February 12, following the stage of maximum turbidity. In general, the analyses indicate conditions which have prevailed on the other examinations at Warren; namely, that the river is badly polluted immediately following the first washing after heavy local rain, and that, as indicated by the coli results, this pollution does not long continue. Considerable iron was present in the raw water, most of which is apparently in suspension as indicated by the small quantity noted in the filtered water.

On account of the flood conditions in the river and the tremendous dilution thus afforded, no samples were collected from the sewage purification plant at the Trumbull County Infirmary nor from Young's Run. Pollution from these sources would presumably be negligible during flood stages.

Below Warren.

At the serial station below Warren, the river was very swift and the outlets of all the Warren sewers were submerged. The volume of the river water was increased very much compared to that of the sewage, which itself was very dilute due to roof water and storm water. The physical character of the water followed closely the variations noted in the station above Warren. The alkalinity became less during the sampling and was noticeably higher than above Warren, indicating the effect of the Warren sewage. The total bacteria were very much lower than found below Alliance, suggesting the effect of the tremendous dilution of the Warren sewage and the dilute character of the sewage itself which prevailed during this flood stage of the river.

Above Niles.

The analyses of serial samples collected above Niles showed the effect of the varying stage of the river. The river rose up to about midnight on the first day of the sampling, but subsequently fell rapidly. There was a marked increase in turbidity and a decided reduction in alkalinity, corresponding to the dilution afforded by the rising stream. The total number of bacteria increased about threefold during the first day's sampling. On the morning of the second day, however, after the river had fallen considerably, the number of total bacteria increased, the turbidity decreased and the alkalinity was reduced to only 13 parts million. The analytical data for the above station suggests very interesting facts relative to flood conditions in the Mahoning River at Niles with special reference to the pollution which enters the river above this point.

Below Niles.

Below Niles at the Erie Railroad bridge, there was maintained a serial station where samples were collected corresponding to those above the city. The first three samples were not in full current and hence the turbidity was possibly not so high as would be found in the middle of the stream. The last sample, however, was collected from the center of the river. In general, the analytical data are practically the same as above the city, suggesting that the immense volume of water in the river obscured the effect of the Niles sewage. The river was very much more polluted bacterially at both stations at Niles on February 14 and 16 than was found below Warren on the 11th and 12th. The rising river appears to be the explanation of these results.

Mosquito Creek. Mosquito Creek, which was in flood showed a high turbidity, low alkalinity, and some pollution as indicated by the total number of bacteria and the presence of coli. The analyses similarly indicate the rural pollution which this creek receives, and quite probably during such flood conditions as prevailed on February 11, still further polluting material is swept into the river. This sample and that at Meander Creek were collected on the same day as those below Warren.

Meander Creek. The water in Meander Creek on February 11 showed much less turbidity than Mosquito Creek, presumably owing to the fact that less rain had fallen on its watershed. The number of bacteria, however, were about twice as high as found in Mosquito Creek, but the number of coli was only about half as great.

Below Girard.

Two samples were collected below Girard on February 15. In considering the analyses of these samples, it is necessary to refer to the previous statement of weather conditions. The very rapid rise in the river on February 14 and 15 reached a crest early on the morning of the 16th, and according to the analyses it is evident that the turbidity and bacterial crests were reached sometime during the night ot the 15th. A sample collected on the evening of February 15 showed the most pollution, most turbidity, and the softest water of the three samples. On the morning of February 16 at least 6 feet of water were flowing over the dam at Girard and the river had overflowed its normal banks.

Briar Hill.

Following the crest of the second rise in the river on February 17 and 18, there were collected four samples at the serial station at Briar Hill. The alkalinity of the water was very much lower than noted at Girard on the previous day. The total bacterial content showed much variation and was fairly low. The number of coli was about the same as noted on the two previous examinations. It is interesting to note the fairly uniform character of the river water at different points, at least between Warren and Briar Hill, attributable to the effect of high water.

Intake Youngstown Water Purification Plant.

Samples were collected at the intake of the Youngstown water purification plant on February 17 and 18, simultaneously with those at Briar Hill and Haselton. As noted on previous examinations, the analyses indicate considerable variation in the character of the river water, especially as regards the turbidity and total bacteria. During the examination there was a marked decrease in turbidity but practically constant alkalinity which was very low. The analyses suggest that even during high stages, considerable pollution enters the river between this point and Briar Hill. The analysis of the sample collected on the morning of February 17 especially illustrates this point. It appears also that the water in the river is more polluted in the morning than in the afternoon or evening.

Below Haselton Bridge.

At the same time samples were collected at the two stations just discussed, the character of the river water was investigated at the serial sampling station below Haselton. The high water in the stream greatly reduced the effect of the pollution which existed at this point on the second examination, but as the analyses indicated, there were many more bacteria present at this point than above Briar Hill. The water was very much harder than above Youngstown. The ore dust was not so much in evidence and the character of the water as shown by analysis was very much better than on the first and second examinations.

Above and Below Struthers.

Serial stations were maintained above and below Struthers, but no attempt was made to collect manufactural wastes and in most instances the outlets from the manufacturing plants were completely submerged. The analyses indicate that the character of the water above and below Struthers was substantially the same. The total number of bacteria above Struthers was slightly less than below and considerably less than at the Haselton bridge station. Conditions at Struthers appear to be largely dependent upon the acid iron wastes discharged by the Youngstown Sheet & Tube Company's plant above the village, and also upon the volume of these wastes discharged into Yellow Creek from the rod and wire mill of this company located below Struthers. It is to be noted that the company has greatly enlarged its Struthers plant and has constructed an intake on the south bank of the river about 600 feet below the mouth of Yellow Creek.

Below Lowellville.

Serial samples collected at the station below the Lowellville dam during this examination showed a water of a character similar to that below Struthers, indicating that during this high flood flow the effect of the sedimentation between Struthers and Lowellville is greatly reduced. The turbidity and the alkalinity were substantially the same as below Struthers, but the total bacteria were slightly lower. The river was falling during the period of sampling and there was a continued decrease in total bacteria and turbidity. As previously mentioned, the flow of the river on February 19 was 1,295,000,000 gallons in twenty-four hours.

It is interesting to compare these figures with the results of analysis of a sample collected at this station on February 12, during the first rise of the river. This water contained very much fewer bacteria but somewhat more coli, was more turbid and considerably harder than the averages of the four samples collected on February 18 and 19. Presumably the flow of the river was somewhat lower than when the serial sample was collected, and hence the sedimentation and coagulation afforded between Struthers and this sampling point were more pronounced.

SELF-PURIFICATION.

The previous discussion has indicated many sources of pollution, and the analytical data collected on the three field examinations have suggested the effect of these different polluting agencies upon the waters of the stream. As the water flows farther from the point at which the pollution enters, certain powers of self-purification develop and in a comparatively short distance the visible pollution disappears almost completely. In the Mahoning River these conditions appear to be due to the combined action of natural agencies and manufactural wastes, chiefly those from acid pickling baths. The fact that during each of the three examinations, each of which was under entirely different conditions, the water practically as it flowed into the state of Pennsylvania was but slightly polluted from either a chemical or a bacterial standpoint, suggests that notwithstanding the tremendous quantity of filth and refuse poured into the stream, conditions are such as to remove, temporarily at least, the greater part of the effect of this polluting material. The cause of this somewhat surprising condition is important and interesting. In this section it is therefore planned to discuss the various agencies at work in the regeneration of the Mahoning River throughout its course in Ohio. The points on the river at which considerable pollution enters or below which there are marked evidences of the self-purifying power of the natural stream, in most instances aided by manufactural wastes, are the following: Sebring, Alliance, Warren, Niles, Haselton bridge and Struthers.

Sebring.

As already related, the sewage of Sebring is discharged without treatment into one of the small tributaries of the Mahoning River at a point above that at which there is derived the impounded supply of the city of Alliance. Practically at the outlet of the Sebring sewers, the sewage mingles with the waters from Sulphur Creek which rises in an abandoned coal mine and carries free acid and large quantities of dissolved iron. On the first two examinations the effect of this iron water on the Sebring sewage was a marked coagulation with a removal by subsequent sedimentation of sufficient organic matter to render the supernatant water entirely unobjectionable and thus non-putrescible. This natural process of chemical precipitation of course entails the production of large quantities of sludge.

During ordinary dry weather, as a result of the mixture of the iron bearing Sulphur Creek water with the Sebring sewage, the water which eventually flows into the Mahoning River is of very good quality from the standpoint of organic matter. As previously mentioned, this natural process of chemical precipitation does not completely remove the pollution caused by the Sebring sewage, as indicated by the presence of B. coli. The chemically precipitated masses of organic matter are merely held back on the bed of the stream and with the advent of high waters are washed into the Mahoning River. It is important, however, to note that during dry weather, when public nuisances are most pronounced from polluted streams, conditions at Sebring are such that the offensiveness of the village sewage is entirely removed before it reaches the Mahoning River.

Below Alliance.

The most striking point of pollution on the upper portion of the Mahoning River watershed is immediately below Alliance where there is discharged the chemically treated and settled sewage of the city of Alliance. This investigation has shown that during low water and in fact under conditions which prevail except during floods, the relative volume of river water and clarified sewage is such that there exists a very marked public nuisance. In fact, the pool a short distance below the Alliance sewer outfalls is in effect a septic tank; the waters are black, bubbles of gas are in evidence, and the bed of the stream is covered with black masses of foul sewage sludge.

The investigation of the river at points below Alliance showed that in eight miles practically all traces of the marked organic pollution had disappeared. This was, however, not true of the bacterial pollution, although the bacteria and B. coli were greatly reduced in numbers. This remarkable self-purification is perhaps explained by the numerous pools and riffles of which the river is composed during low water. The pools afford ample opportunity for sedimentation and the riffles supply the oxygen necessary for the destruction of the organic matter. Possibly the masses of chlorophylic algae noted in the river below Alliance materially assist in the regeneration of the water owing to the nascent oxygen which they supply.

The result of the various agencies at work in the purification of the river below Alliance is practically to eliminate visible evidences of the pollution within a distance of eight miles. Moreover, at Newton Falls, distant about 22 miles by river, aside from the bacterial results, no data were obtained to indicate the tremendous quantity of organic matter discharged into the river at Alliance. It of course follows from the above that with the advent of high water much of the deposited organic matter is carried downstream, and the river at such times is no doubt considerably polluted bacterially from the organisms present in the foul deposits on the bottom of the stream. Of course, the organic pollution would be largely offset by the high dilution then available. Under conditions of low flow, the river water at Newton Falls carries no more bacteria and coli than are present in the West Fork which receives pollution merely from rural sources. There is, of course, no evidence to indicate the origin of the bacteria present in the main river at Newton Falls.

Warren to Girard.

Conditions which existed at Warren during the second examination made under maximum low flow conditions, would appear to correspond to the maximum polluting effect of the Warren sewage. At this time the water below Warren was very grossly polluted by the Warren sewage, but conditions were not such as to warrant considering the river a public nuisance. In the flow of five miles to Niles, the organic quality of the river was improved somewhat, presumably due to aeration and sedimentation, but the change was not especially pronounced. At the station above Niles, practically as high bacteria were noted as below Warren. These conditions were found to exist on both the summer and autumn examinations, the one under moderate and the other under maximum low water conditions. During ordinary low water and especially true on the second examination, beginning a short distance above Niles, the river is ponded by the Girard dam. This pond practically creates a natural sedimentation basin and thus markedly improves the polluted Mahoning River water. Moreover, within the corporate limits of Niles, there enter the two large tributaries, Mosquito and Meander creeks, and the added dilution thus afforded is also a large factor in offsetting the effect of the sewage of Warren and Niles. During dry weather the flow of these two streams is very slight and the dilution they afford practically negligible. Furthermore, Mosquito Creek is very grossly polluted in Niles by domestic sewage.

On the first two examinations there was a marked difference in the quality of the water at Niles and at Girard. The improvement was especially pronounced on the second examination. The clarification of the water effected by the natural agencies of sedimentation afforded by the Girard dam on the second examination was greatly assisted by the acid iron wastes which are discharged into the stream a short distance below the Erie Railroad bridge at Niles, and at two other points between this station and the Girard dam. Although these wastes, especially during low water, discolor the stream for some distance below their points of entrance they have a marked beneficial effect upon the polluted river water; they greatly reduce the quantity of organic matter, suspended matter, and bacteria by supplying a coagulant which causes these matters to settle out in the basin formed by the Girard dam. It is, of course, true that this improvement of the water entails the disposition on the bottom of the stream of large masses of putrid sludge, and that on the advent of high water these are carried downstream and in part increase the organic pollution of the river water and no doubt the bacterial contamination as well. While this is true, it also appears that at times of flood flows the oxygen available for the oxygenation of the organic matter is supplied in relatively large quantities so that at least, according to the results obtained on the third examination, the actual visible and organic pollution of the river is not particularly pronounced.

Girard to Briar Hill.

Further improvement in the quality of the water was noted on the first and second examinations during its flow from Girard to Briar Hill. The river was so low and the current so slight that sedimentation was greatly favored. Some riffles in this section of the stream no doubt assisted in the purification of the water. But little industrial waste is discharged into the river between Girard and Briar Hill. It is true, of course, that the bacterial pollution is by no means removed, and it is evident that the river water at this point should never be used for drinking purposes.

Briar Hill to Struthers.

With the exception of conditions a short distance below Alliance, practically the most polluted stretch on the entire river is between Briar Hill and Struthers and especially between Crab Creek and Struthers. In this stretch during rains there enters the drainage from the thickly settled unsewered area north of and within the northern corporate limits of Youngstown, the wastes from a large number of steel plants, Crab Creek carrying with it the sewage from a majority of the sewers of Youngstown, manufactural wastes and sewage from the remainder of the sewers of the city and acid iron wastes and sanitary drainage from the large works of the Youngstown Sheet & Tube Company. The river water just below Haselton bridge, that is after it has received the sewage and manufactural wastes from the city of Youngstown and vicinity, has been found in this investigation to be very grossly polluted. Conditions in this regard were most pronounced during the maximum low water of the second examination but were such as to show what would ordinarily be classed as "marked sewage contamination" under the moderately low water of the first examination. On the third examination the enormous flow of the stream tended to lessen the effect of the pollution, although its presence was readily detected by bacterial analysis.

At Struthers, only two miles below Haselton bridge, the condition of the river is at times somewhat improved by the combined effect of sedimentation afforded by the Struthers dam and coagulation or chemical precipitation produced by the acid iron wastes from the plant of the Youngstown Sheet & Tube Company. These wastes discolor the stream to such an extent that in moderately dry weather, the brick red color of the water is visible from the plant to the dam at Struthers. Upon entering the stream the acid from wastes are very rapidly coagulated; they in part precipitate carrying with them considerable of the organic matters introduced in the river by the Youngstown sewage, While the presence of these acid iron wastes in a measure temporarily improves the quality of the water, at very low stages such as were noted on the second examination, the enormous quantities of the precipitated filth held in suspension in the water emits considerable odor and is very objectionable. Furthermore, it is important to note that the tremendous volume of sludge which results from the action of the iron in considerable part sinks to the bed of the stream during the continuance of fairly low stages and at the advent of a sharp local rain is scoured out and carried downstream. It is stated that during the first rise after the protracted drought in the fall of 1908, tremendous masses of black sludge were noted in the river above the Struthers dam. It is very probable that such objectionable conditions frequently occur after sharp local rises.

Struthers to Lowellville.

Just below Struthers the river receives additional acid iron wastes which discolor the stream for some distance below. In the stretch between Struthers and Lowellville, further opportunity is afforded for the clarification of the river water by both subsidence and chemical precipitation. The effects of the Lowellville dam and the acid iron wastes which enter at Yellow Creek are most pronounced. As the analytical data on the first and second examinations clearly indicate, the water at Lowellville exhibits relatively marked purity considering the vast volume of filth which has been poured into the stream above. The river water during the worst stages at Haselton was practically devoid of oxygen. At Lowellville the oxygen was restored, partly owing to the effect of the Struthers and Lowellville dams and possibly the catalytic action of the iron from the pickling liquor introduced by Yellow Creek.

Summary.

From the above discussion, it is apparent that, while there are several points where the river is grossly polluted by domestic wastes, opportunities for the purification of the river, ordinarily classed as agencies of self-purification, obtain in a number of instances, and their effect is so enhanced by the presence of acid pickling liquors that the greater part of the domestic pollution of the stream is removed before it leaves the state.

PUBLIC WATER SUPPLIES ON WATERSHED.

During this examination, special attention was paid to the question of water supplies derived from the river or its tributaries, and also to the supplies of all the incorporated communities on the watershed. Supplies drawn from the river are of special significance with reference to the effect of sewage, in view of the fact that a population of about 87,000 people is dependent upon the Mahoning River for its drinking water.

The water supplies investigated and hereinafter discussed, grouped under the heads of surface, impounded, surface filtered, and wells, are as follows:

Surface. Sebring.
Impounded. Alliance, Struthers.
Surface Filtered. Warren, Youngstown.
Wells. Newton Falls, Niles, Garrettsville, Hiram.

These water supplies are discussed with reference to the character of the water works, capacity of the supply, and quality. Supplies drawn directly from the river and used either after impounding or after filtration, are further discussed with reference to the effect of the sewage from points above upon the potability of the water as delivered to the consumers. Conditions at Youngstown are of special importance in this connection and are reviewed at some length.

Sebring.

The village of Sebring has an estimated population of 2000 and is on a small tributary of the Mahoning River in Mahoning County about two miles east of Alliance. The public water supply, derived from the main branch of the Mahoning River at a point about three miles above Alliance, is pumped directly from the river through a force main about 1½ miles in length to a standpipe distant about ¾ mile from the village. The water consumption is stated to be 125,000 gallons daily.

During the first and second examinations, there were collected samples of the Sebring water supply from the intake at the water works and also from a tap in the village. The water in the Mahoning River at the intake of the Sebring water works was, on each examination, found to contain evidences of pollution. The samples from a tap in the village showed some improvement over the river samples.

The turbidity of the Sebring water is at times very marked, especially after rains, and is a very objectionable feature of the supply. The hardness is also high at times. These conditions, particularly the presence of somewhat large numbers of bacteria and coli, indicate that the supply is objectionable as now drawn from the river directly.

The pollution of the river due to heavy local rains and the frequent high turbidity in the supply, suggest that a mechanical filter plant would be of great value in producing a potable water supply for Sebring.

Alliance.

The city of Alliance has an estimated population of 14,600, and obtains water from the Mahoning River from a point directly above the dam at Alliance. The water flows from the dam into a sedimentation canal, which affords about one day's storage. The daily pumpage is about 3,136,500 gallons.

As indicated by the analytical data obtained upon each of the field examinations and as previously discussed, the Alliance water supply is at times polluted, especially after local rains and during wet weather. Presumably a large part of this pollution is derived from a number of small brooks, drains, and storm sewers, which discharge into the river above the city at East Alliance. Furthermore, the present method of disposing of the Sebring sewage may not be adequate to safeguard the Alliance water supply. This feature particularly relates to the scouring of Sulphur Creek channel during rains and the disposition of the precipitated Sebring sewage sludge into the Mahoning River, and incidental thereto the introduction of sewage bacteria.

Considering all these features and sources of pollution, indications are strong that the unpurified Mahoning River at Alliance is not a safe nor a satisfactory source of water supply for the city. Although the Alliance dam and canal greatly improve the character of the river water, the water supply of Alliance would be much more wholesome and desirable if it were filtered to remove both bacteria and turbidity.

Another feature regarding the Mahoning River as a source of water supply for Alliance is the question of the water available. The drought in the fall of 1908 was so intense that the flow of the Mahoning River at Alliance according to measurements made during this investigation fell to about 3,500,000 gallons daily. In fact, the water became so low above the dam that it was necessary to provide a special pump to lift the water impounded above the dam into the water works canal. The margin between the daily needs of the city and the flow of the river was very slight. The importance of this question is apparent when there is considered the fairly rapid growth of the city and the increasing water consumption in late years. Data as to population and water consumption per annum are not available for many years past, but from the records of 1905 and 1908 some conception may be had of the growth of the city and the increase in water consumption. The population in 1905 was 12,000 and during 1908 it was 14,600. Correspondingly, the average daily water consumption for these two years was 2,490,000 and 3,136,500 gallons, respectively. In view of these conditions, it is apparent that there is barely sufficient water during dry seasons to correspond to the needs of the city, and hence the increasing volume of water required for the future growth of the city must be obtained elsewhere.

It is understood that the city of Alliance has quite recently been investigating the question of an additional water supply.

Struthers.

The village of Struthers has a population estimated at 3500 and is about 3.2 miles below Youngstown. It has a public water supply derived from a reservoir formed by a dam in Yellow Creek at a point about two miles above its confluence with the Mahoning River. This dam, owned by the Mahoning Valley Water Company, is about 60 feet high, floods an area of approximately 100 acres, and is said to have a capacity of 750,000,000 gallons.

On the first and second field examinations, samples of this water were drawn for analysis from a tap in the office of the Struthers Furnace Company. In 1908 it was stated that there were but few consumers, although during the extreme drought in the fall of 1908, the Struthers Furnace Company alone is said to have used daily of this water about 250,000 gallons. The analyses of this water indicate that it is soft, of low turbidity and bacterial content. On each of the examinations the water was found to be but slightly oxygenated, and on the first examination contained only 12 per cent saturation; on the second examination 35 per cent saturation. The water contained large numbers of cyclops and is evidently of a character similar to surface supplies stored in open reservoirs. On the first examination there was practically no pollution as coli were not present even in 50 cubic centimeters; on the second examination, however, coli were present in 3 cubic centimeters but absent in one cubic centimeter.

According to these analyses, this water does not appear to be entirely satisfactory for domestic use without filtration, owing to the presence of microscopic organisms with their accompanying tastes and odors, and some slight pollution as indicated by the presence of B. coli. It is evident that rigid patrol of the Yellow Creek watershed is essential to insure the potability of this supply.

Warren.

The water supply of Warren is obtained from the Mahoning River which is dammed just northwest of the city. The average daily consumption is about 858,000 gallons. The river water is filtered by mechanical filters of the wooden tub type after clarification by a coagulant (sulphate of alumina) and a short period of subsidence. The entire plant comprises: An intake above Camp and Randall's dam; a low service pump; a settling basin and coagulating system; six wooden mechanical filters; a clear well; and two high service pumping plants, one in the building adjacent to the filter house and used for fire protection and forcing the water directly into the mains; the other located on the opposite side of the river at the lighting plant and used to lift the filtered water to the standpipe. The latter supplies the ordinary consumption.

During 1906-7 the operation and efficiency of the Warren water plant were critically examined by the Board. A detailed description of the plant and an account of the operation and efficiency during the above period will be found in the special report of the State Board of Health on Water and Sewage Purification in Ohio, 1908, pages 268 to 281.

During the present investigation, the operation of the filter plant and the quality of the raw Mahoning River water and its effect thereon were carefully investigated on each of the three field examinations. On the first examination, conditions were very satisfactory. No coli were found in the filtered water even in 50 cubic centimeter portions.

During the second examination, at the Warren filter plant, the river water was exceptionally low and its alkalinity was higher than ever found previously.

The analyses of the raw water indicate that at the time of the examination the raw water was polluted but that it was improving in quality during the test. Prior to the examination there was a light rain, to which the pollution noted at the beginning of the test may be attributed. The analyses of the filtered water indicate that the supply was clear and of generally satisfactory quality. It is of interest to note the presence of B. coli in a few of the samples in a volume of 50 cubic centimeters. During the previous examination, no coli were found in 50 cubic centimeters. As true at all previous examinations, the bacteria in the city mains were less than at the plant.

The character of the raw water during the third examination of the Mahoning River has been previously discussed and suffice it here to recall that the river was in normal flood and was of moderately high turbidity and considerably polluted. The alkalinity in the river water was so low that it was necessary to use lime to furnish sufficient alkalinity to decompose the sulphate of alumina.

The general evidence obtained on this examination indicates that the Warren purification plant accomplishes a satisfactory purification of the water at all times except when for any reason it is necessary to operate the filters at high rates. The comparatively low efficiency of the filters at such times is apparently due to the fact that they contain but 22 inches of sand which has an effective size of 0.78 m. m. and is thus much coarser than that now used in filter plants of modern construction.

In conclusion, it is to be stated that while the Mahoning River water at the Warren water works intake is generally polluted as indicated by the presence of coli, and while at times it contains considerable material in suspension, yet the general effect of the Warren water purification plant is to furnish ample protection to the consumers and to deliver a water which is clear and potable. This fact is further shown by the general absence of typhoid fever in the city.

Youngstown.

The water works of the city of Youngstown were installed in 1872 and until 1903 the supply was taken directly from the Mahoning River without purification. During this time the city had an unusual high death rate from typhoid fever; in fact, the total death rate from this cause was one of the highest of any city in the United States. The quality of the water in the Mahoning River was considered such as to be an important feature in the causation of the disease. Furthermore, the Mahoning River water generally contained objectionable quantities of suspended matter and color and was not well adapted for domestic use.

Investigations of possible sources of water supply were made in 1893 by Mr. George W. Fuller, on whose recommendation there was constructed in 1905 a ten million gallon mechanical filter plant for the purification of the Mahoning River water. The report showed the supply from the Mahoning River to be sufficient for the needs of the city, provided the water consumption did not exceed 8,000,000 gallons daily. Subsequent to this period an additional source of water supply would be necessary.

The construction of the plant has been fully discussed in the special report of the State Board of Health on Water and Sewage Purification in Ohio, 1908.* Suffice it here to state that the plant comprises: An intake of special design located about 500 feet above the old pumping plant; a low service pumping plant; two coagulating basins; means for dissolving and applying a coagulant; twelve concrete gravity mechanical filters; a concrete covered basin for storage of filtered water; together with the necessary means for carrying the clear water to the old pumps which are still used to supply the distribution system and standpipes. The filters and coagulating basins are contained in a substantial building just north of which is the clear well.

The average daily consumption for Youngstown in 1907 was 6,075,000 gallons; for the year 1908, 6,612,000 gallons; July, 1909, average daily consumption 7,260,000 gallons, maximum 8,525,000 gallons. A conservative estimate of the minimum dry weather flow of the Mahoning River at Youngstown is 15,000,000 gallons per day. In view of the large annual increase in population it is apparent that in the not far distant future additional sources of water supply for the city will be required, as previously predicted. It is understood that plans have recently been set on foot to obtain an additional supply.

During this investigation the operation and efficiency of the Youngstown water plant for the purification of the Mahoning River were examined on each of the three field examinations. The relation of the water supply of Youngstown and the pollution of the river by the sewage of the cities, villages, and manufacturing establishments above the intake and as well that introduced by the unsewered area north of the city, is of marked importance and significance in this regard.

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*See pp. 282-303.

The general character of the raw Mahoning River water at the intake of the Youngstown filter plant has been thoroughly discussed. The important features for discussion here relates to the sudden and very dangerous pollution of the river water at the Youngstown intake, due to the effects of heavy local showers. This sudden washing of objectionable material into the Mahoning River between the sampling station at Briar Hill and that at the intake of the Youngstown water works appears to be directly due to the absence of sewers and proper drainage in the district above the filter plant. In this area there are approximately 15,000 people who make but little use of the public water supply and have no modern sanitary conveniences.

The fluctuations in the quality of the raw water at Youngstown naturally have a decided effect upon the operation and general efficiency of the Youngstown filter plant in producing a safe and potable supply. The analytical data obtained on the first examination are of great interest as showing the effect of the degree of pollution of the river water upon the character of the filtered water. The evidence indicates that even with a fairly high percentage of removal of bacteria, it is very difficult to eliminate all traces of pollution in the filtered water.

During the second examination of the Mahoning River, conditions at Youngstown were those of extreme drought. The river water at the intake of the Youngstown filter plant contained greater numbers of bacteria, less turbidity, and less dissolved oxygen than samples collected at Briar Hill. On acount of the very low stage of the river, the effect of the wastes from the two mills of the Ohio Steel Company was very pronounced. The very very large volume of these wastes is apparent in considering the higher temperature of the river water at the intake of the Youngstown filter plant in comparison with that at the Briar Hill station. Bacterially, the raw water was less polluted than on the first examination, during which there fell a heavy local rain.

The analyses of samples of the filtered water indicated a very high bacterial removal (over 99 per cent) and in general the water was of satisfactory quality. B. coli were present in 25 cubic centimeters but not in 3 cubic centimeters. During this examination, therefore, the polluted Mahoning River water was receiving sufficient purification to render it satisfactory for a public supply.

During the third examination the operation of the Youngstown filter plant was again investigated. At this time the quantity of water pumped varied from 6,814,000 to 7,180,000 gallons and for February, 1909, averaged 6,870,000 gallons. On February 15 and 16, two days prior to the beginning of the test, there had been a heavy rain followed by a sudden and decided rise in the river. On the 17th and 18th, the days of the tests, the river was falling.

As previously found, the analyses of the river water indicated a decided variation, especially as regards turbidity and bacteria.

The alkalinity in the river water was at this time very low, and it is apparent that there was but little margin between the alkalinity and the quantity of coagulant applied. It is apparent that the river in its flood stages carries considerable suspended matter, and in view of the very low alkalinity at such times, devices should be available for the application of an alkali to prevent the passage of undecomposed coagulant into the clear well.

The analyses indicate that the plant was producing very satisfactory results. The bacterial removal was over 99 per cent, notwithstanding the comparatively small quantity of coagulant applied.

It has been mentioned that the sudden marked increase in pollution of the Mahoning River water at the intake of the Youngstown filter plant makes difficult the production of a safe water for domestic consumption. It is apparent that a raw water subject to such wide and sudden fluctuations will acquire an unusual degree of supervision and expert control in the management of the water purification plant.

The Youngstown filter plant is under the direction of a superintendent who makes daily, morning and evening, two complete analyses of both the raw and filtered water. The determinations made include the usual constituents which comprise the chemical analysis of water for filter plant control, together with determinations for total numbers of bacteria and B. coli in amounts of 0.1 cubic centimeter of raw water, and 1 cubic centimeter, 25 cubic centimeters, and 50 cubic centimeters for the filtered water. Lactose bile broth is used in the determination of coli.

Excellent records are kept of the operation of the Youngstown filter plant and these embrace the daily enumeration of the above analytical data, together with daily records of the quantity of water filtered, the quantity and cost of coagulant, and the percentage of wash water used. Monthly averages of these daily analyses as sent each month to the State Board of Health are shown in Table No. 11. They are of interest as showing the efficiency of this plant in handling the variable pollution which exists in the Mahoning River at the Youngstown water works intake.

TABLE NO. 11.

MONTHLY AVERAGE OPERATION DATA, YOUNGSTOWN FILTER PLANT FOR THE YEAR 1908.

Month.	Quantity of water filtered. M. Gal.	Sulphate alumina. Grs. per Gal.	Turbidity.	Parts per Million.										
					Alkalinity.		Incrustants		Bacteria per c.c.		B. Coli.			
											River.*		Filtered water.‡	
				Color.	River.	Filtered.	River.	Filtered.	River.	Filtered.	0.1 c. c.	1 c. c.	25 c. c.	50 c. c.
January	6,137	1.90	46	35	39	27	......	......	31,320	380	97	95	......	47
February	6,642	1.70	89	38	40	28	30	39	20,400	386	91	95	......	44
March	6,207	1.71	21	39	28	17	30	42	25,770	325	88	98	......	40
April	5,701	1.71	69	50	40	31	31	42	18,430	203	100	90	......	0
May	6,076	2.12	91	78	37	25	29	41	17,730	214	96	56	......	12
June	7,010	1.98	24	48	88	73	56	72	12,380	132	96	83	......	15
July	6,533	2.05	34	38	89	73	51	62	41,900	340	100	82	33	0
August	7,204	2.60	48	30	94	73	66	84	38,700	280	63	85	48	11
September	7,308	2.67	21	24	106	82	79	102	61,000	860	83	98	31	......
October	6,988	2.76	19	18	113	89	112	136	35,800	240	77	98	77	......
November	6,482	2.20	26	17	121	102	97	106	26,500	310	52	100	86	25
December	7,061	2.71	28	16	129	107	77	101	29,000	680	89	97	54	23
Average ..	6,612	2.17	43	36	77	61	59	75	29,490	362	86	95	64	32

* Per cent. positive tests.

‡ Per cent. negative tests.

In general, the investigation has indicated that the pollution of the Mahoning River at the intake of the Youngstown water works is so pronounced after sharp rains as to cause considerable difficulty in the operation of the plant and to render almost impracticable the production of a safe and potable water. The evidence is strong that the immediate source of this pollution is derived from the unsewered, thickly populated area north of the intake. While there exists in the river, particularly during all stages, a constant pollution as shown by the bacteria and coli, due to the effect of the sewage of the communities above Youngstown, yet during sharp local showers which occur at moderate stages and at low water, the effect of the pollution introduced into the river immediately above the Youngstown intake is much more pronounced.

This feature is further of marked interest since considerable thought has been given to a plan of impounding one of the tributaries of the Mahoning River in Berlin Township with a view to providing at all times a fixed minimum flow through this partial conservation of the flood waters.

It is apparent from the results of this investigation that the plan would not be altogether desirable with reference to the water supply of Youngstown, in view of the present pollution which enters the river a short distance above the present intake. It is true, of course, that greater dilution would then be available, but it is questionable whether even then the filter plant could produce a satisfactorily purified water at all times. Further, thought should be given to the probability of the rapid development of manufacturing plants above the intake and above Briar Hill as soon as there is provided a greater volume of flow in the river. These plants would no doubt introduce considerable pollution and would thus in a measure offset the beneficial effect of the increased dilution then available.

In view of these considerations, it appears to be clear that some steps should be taken to improve the present source of water supply of Youngstown with special reference to the occasional difficulty of obtaining an entirely satisfactory supply through the medium of the filter plant as it now exists and as it is at present operated. Several suggestions are made, any one of which would improve present conditions.

1. That the intake be removed to a point on the river above the pollution introduced from the unsewered area immediately north of the city.

2. That the use of the present intake be continued with provisions for (a) the application of hypochlorites whenever the character of the river water as shown by analysis is such that the present devices cannot furnish a satisfactorily purified water; and (b) the use of a greatly increased quantity of coagulant at times of grossly polluted raw water.

3. That an effort be made to obtain a supply from a source other than the Mahoning River.

4. That there be installed in this area above Youngstown a public water supply and a system of sanitary sewers the outlet of which shall be at a point in the river below the intake of the Youngstown water works.

5. That the sewage of all communities above Youngstown and on the Mahoning River be subjected to treatment sufficient to remove all offensiveness, with a view to minimizing the work required of the Youngstown filter plant.

Newton Falls.

During this investigation the village of Newton Falls had no public water supply. In the summer of 1908, however, plans were developed for a well supply. Experiences at Newton Falls relative to obtaining a satisfactory water from ground sources are of interest with reference to the present problem and also as indicating the character of ground water obtained at different depths.

There are two possible methods for obtaining a satisfactory water supply at Newton Falls; one the filtration of the Mahoning River, the other obtaining water from ground sources. The latter method is, of course, the least expensive. Early in June, 1908, the village began drilling for water and up to about the first of October drilled three wells at different points within the corporation. The first was an 8-inch well, 58 feet deep, which pierced in order 10 feet of soil and drift, 3 feet of shale, 19 feet of yellow sandstone rock, and 26 feet of a white sandstone rock. Analysis of water from this well showed that it was satisfactory for domestic use except that it contained 3 parts per million of iron which rapidly settled out, forming a heavy red sediment.

The high iron was thought to be due to the excessive depth of the well, and subsequently on the same lot a well was drilled to a depth of only 35 feet. This well likewise afforded a water which was satisfactory with the exception of its iron content which was 20 parts per million. Failing in these efforts to obtain a satisfactory water at this point, a third test well was drilled in a triangular lot located in the southeastern part of the village on the East Fork of the Mahoning River near the L. E., A. & W. R. R. station. This well, 8 inches in diameter and 103 feet deep, pierces in order 8 feet of drift, 21 feet of sandstone, and 74 feet of blue slate. The analysis of this sample was again satisfactory in all respects with the exception that the iron was 4.5 parts per million and that the water rapidly became cloudy, showing a heavy precipitation of iron in twenty-four hours.

In view of the fact that the location of the well was satisfactory and that the water was suitable for domestic uses in all respects with the exception of the high iron, this source of public supply was approved by the Board, providing that an iron removal plant be provided in the proposed water works.

The water works plant in the village was constructed in the late fall and summer of 1908 and comprises a driven well, a pumping plant, air compressor, storage tank, and a distribution system. As yet no plans have been developed for the construction of the iron removal plant which is essential in insuring a satisfactory supply for the village.

The character of the water from the test wells is shown in the following table:

TABLE No. 12.

ANALYSES OF WATER FROM TEST WELLS AT NEWTON FALLS.

(PARTS PER MILLION.)

Sample Number.		7605	7791	7989
Date of collection		June 17, '08.	Aug. 17, '08.	Oct. 2, '08.
Color		trace	none	none
Turbidity		100	100	80
Sediment		decided	slight	decided
Odor		none	none	none
Nitrogen as	Albuminoid ammonia	0.028	0.06	0.166
	Free ammonia	0.004	none	0.014
	Nitrites	none	none	trace
	Nitrates	trace	none	none
Oxygen required		0.90	1.50	1.32
Chlorine		6.9	6.5	4.5
Alkalinity		74.0	17.0	104.0
Incrustants		29.	25.	35.
Iron		3.0	20.0	4.5
Total solids		210.0	147.0	195.0
Loss on ignition		51.0	....	12.0
Bacteria per c.c		652	110	330
Colon present		Not in 50 c.c.	not in 1 or 50 c.c.	not in 50 c.c.

SOURCE OF SAMPLES.

Sample No. 7605 From first 8-inch drilled test well, 58 feet deep.
Sample No. 7791 From second 8-inch drilled test well, 35 feet deep.
Sample No. 7989 Frim third 8-inch drilled test well, 103 feet deep.
On triangular lot near East Fork of Mahoning River.

NOTE: Turbidity and sediment in all of the above samples due to the precipitation of iron after collection of sample.

Niles.

The city of Niles has had a public water supply since 1891, when the water works owned by the city were installed and operated in conjunction with the municipal electric lighting plant. The works comprise a system of driven wells, one large well which serves also as a receiving well, pumping machinery, air compressor, distribution system, and an equalizing reservoir. For emergency use, an intake is provided in the Mahoning River. The supply is derived from 11 wells driven from 45 to 65 feet to a waterbearing gravel and located on several acres of land adjoining the Mahoning River about 1000 feet south of Main Street. The wells range in size from 5⅝ to 10 inches. The supply thus secured is supplemented by that from a large receiving well, with porous bottom, which is 17 feet in diameter and 70 feet deep.

Water is raised from the small wells by Harris air lifts and is discharged into the large well just mentioned. From this well it is raised by the pumps and forced into the mains and to the reservoir. The pumping plant comprises two compound duplex pumps with 10-inch barrel and 18-inch stroke. The suctions of the pumps are in the large well and the ordinary suction lift is at times fully 25 feet. For emergency use in case the supply from the wells proves inadequate, water may be pumped directly from the Mahoning River through the 14-inch intake.

The pumping station houses besides the pumps, an Ingersoll air compressor belt driven by a motor, equipment for street lighting, and two boilers with a feed water pump and other accessories. The pumps force the water directly into the mains or to a reservoir which serves as an equalizer. This is a covered brick tank 70 feet in diameter and 16 feet deep with a capacity of about 500,000 gallons. The water enters the reservoir at the bottom and is drawn off through the same pipe, so that unless the pumpage exceeds the consumption, no water enters the reservoir.

The Niles water supply, including the wells and emergency intake to the Mahoning River, was never submitted to the State Board of Health for approval. The water consumption in 1908 averaged 400,000 gallons daily.

The occasional use of the polluted river water at Niles has manifested itself at times in an outbreak of typhoid fever in the city. Quite a severe outbreak occurred in the winter of 1901-2.* On investigation it was developed that the typhoid was due partly to the polluted character of the Niles water supply and partly to contaminated milk. It was found that the heaviest outbreak of cases occurred from 10 to 14 days subsequent to an occasion when river water was pumped into the city mains during a fire. At that time the analyses of the Mahoning River water opposite the Niles water works showed marked contamination from the sewage of Warren. Neither a sample of the hydrant water nor that collected directly from the wells indicated excessive bacterial contamination. The evidence, however, showed that a large number of the typhoid fever cases were to be attributed to the pumping of raw Mahoning River water into the city mains. Apparently nothing was done at this time to prevent the further use of the emergency intake.

On the third examination during this investigation of the Mahoning River, it was learned that there were reported in the city a number of cases of intestinal troubles. On subsequent investigation it was developed that some of these were a mild form of typhoid fever.

On each of the examinations, samples were collected from the Mahoning River at a point opposite the pumping station, from the wells, and from one or more taps in the city. In all cases, with the exception of the data secured on the third examination, the bacterial content of the water in the city mains was low. At the same time B. coli were found in the tap water during each examination. On the first examination a single sample was collected from a tap at the Allison Hotel. The chemical constituents found upon analysis indicated a hard ground water; the presence of coli pointed to some source of pollution.

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*See annual report of Ohio State Board of Health for 1902, pp. 192-206.

On the second examination the analysis of a asmple collected at Niles from the above source indicated a badly polluted water. The presence of high numbers of bacteria and considerable numbers of coli appears to be explained by the fact that until two days prior to the examination, as stated by the Niles officials, river water had been pumped into the mains together with ground water from the wells.

The strongest evidence as to the more or less continued pollution of the Niles water supply found in the Mahoning River by the practice of supplementing the well supply by water from the river, was obtained on February 15 and 16, 1909, during the third examination.

On February 12, 1909, samples were collected from the Mahoning River above the Niles water works intake and from a tap in the Allison Hotel at Niles. On February 15 and 16, 1909, four samples were collected from the river and five from the mains at several points in the city. The results of analyses of these samples indicate that on the evening of February 15, about 75 per cent of the water pumped into the Niles mains was unpurified Mahoning River water. The result of this practice is a decided contamination of the Niles public water supply. Moreover, this contamination persisted for a considerable period after the raw river water is shut off, as indicated by the analytical data obtained during this investigation. The data obtained on the third field examination are especially suggestive in this regard.

The data obtained during this investigation have clearly demonstrated that at times the water supply of the city of Niles is grossly polluted, due to the practice of using raw Mahoning River water as an emergency supply. The present emergency intake should either be abandoned or the valves controlling its use should be padlocked and the key kept at the office of the health officer for use in very rare cases of emergency. An additional supply of water should be secured. The present method of operating the plant is expensive since the water is practically pumped twice; that is, it is raised by the air lifts and discharged into the large receiving well, from which it is lifted by the pumps, entailing practically the limit in suction lift. This investigation has shown that some changes are distinctly necessary in the matter of a water supply for the city of Niles, as under present conditions the supply is at times badly polluted and is a marked danger and menace to the health of the city.

Since February, 1909, it is stated that no river water has been pumped into the Niles mains. Present conditions are, however, such that a large fire would necessitate drawing on the river for water.

Recently (August, 1909), the Niles officials have contracted with the Peerless Electric Company of Warren to supply electric current for light and power. It is planned to lower the pumps 20 feet and thus reduce the suction lift. By this means also the large well may be pumped dry if necessary. The Niles officials believe that with this arrangement considerably more water than now available may be obtained from the large well, and that with another dug well there may be obtained at all times an adequate supply of well water. The air lift and wells to which they are connected are to be abandoned. The changes are planned for the near future. This investigation has shown that the well water at Niles is of excellent quality.

Garrettsville.

The village of Garrettsville is in the northwesterly part of Portage County and lies directly on the watershed of Silver Creek, a tributary of Eagle Creek. The village has a population of about 1200 and is composed largely of retired farmers and persons interested in the cultivation of sugar maples. The village has no system of sanitary sewers; cesspools and dry vaults are in general use. Although the village does not obtain its water directly from the Mahoning River or any of its tributaries, yet it is upon the watershed of the stream and is therefore of interest as a point where considerable pollution may some day enter the stream.

The water plant constructed in 1906, comprises a pumping station located about 1½ miles north of the center of the village; ten driven wells which range from 41 to 73 feet in depth; a shallow dug well; an iron removal plant which consists of an aerator, sedimentation basin and mechanical filter and a receiving basin or well into which the water is discharged from the filter; a high service reservoir located on high ground about one-half mile north of the pumping station; a pumping plant; a boiler plant; low and high service pumps; and a distribution system.

The wells and spring are located on Colton and Newcomb's farm just north of the confluence of two small streams. The wells pierce first a layer of yellow clay of varying depth, then a layer of white sandstone rock from 40 to 60 feet in depth, reaching a sandstone stratum of a conglomerate nature and forming the waterbearing gravel from which the wells derive their supply. The well water on analysis was found to be satisfactory except that it contained too much iron.

Iron removal is effected by combined aeration and filtration through a mechanical filter. The aerator is an umbrella shaped device, 4 feet in diameter and approximately 5 feet above the level of the water in the basin. The water from the well is lifted by the low service pump, falls on to this umbrella shaped device and is broken up into a fine spray. The water after sedimentation for a period of about 20 hours is filtered through a mechanical filter which has a total area of 96 square feet, and at a rate of pumping of 2,000 gallons per hour is operated at the rate of 0.34 gallon per square foot per minute or 21,000,000 gallons per acre per day. The filter is backflushed every three days. About 20 per cent of wash water is required.

The results of tests of the efficiency of the plant indicate that it removes about 70 per cent of the iron. Generally the iron in the raw water, which averages about 3½ parts per million, was reduced to slightly less than one part per million in the filtered water. In general, this iron removal plant has very satisfactorily removed the iron and has produced a water which, though hard, is unobjectionable for domestic use. At the present time it is estimated that the water consumption at Garrettsville is in the neighborhood of 25,000 gallons daily.

Hiram.

The village of Hiram is in Portage County about 40 miles south of the city of Cleveland and is near the divide which separates the Mahoning River watershed from that of the Cuyahoga River. Hiram is a small college town, the seat of Hiram College, and has no manufacturing industries. The present population of the college is 280 and that of the village about 610, a figure which is somewhat decreased in the summer when the college is closed. The village has no municipal system of sanitary sewers, but there are one or two private drains, one of which discharges into a ravine at the head of a branch of Silver Creek, a tributary of Eagle Creek.

Since 1897 the village has had a public water supply. Briefly stated the works comprise two springs, used as a source of supply; a receiving well to which the water flows by gravity; a pumping plant; standpipe; and distribution system. The springs are located on the watershed of the Cuyahoga River. Since the water is pumped to the village, the water supply after being used is on the watershed of the Mahoning River.

According to the superintendent, the average daily consumption is about 15,000 gallons. Since the plant was installed, the two springs until recently have been sufficient for the needs of the village. In the fall of 1908, however, the water supply was barely adequate to supply the village and on the approval of the State Board of Health, water from certain other springs, presumably due to the outcropping of the same ground water in the same ravine, were arranged for emergency use. There was no visible source of pollution of this water and its use as an additional supply was approved by the Board on condition that precautions be taken to eliminate all surface water, and providing the supply be used only in cases of emergency such as insufficient water from the original springs during exceptionally dry periods.

SUMMARY.

From many points of view the Mahoning River is one of the most important streams in Ohio. Within the state it has a length of 72.5 miles. It rises in the hills of western Columbiana County and flows through the counties of Mahoning, Stark, Trumbull, back to Mahoning, and eventually into the state of Pennsylvania a short distance below Lowellville, subsequently emptying into the Beaver River, tributary to the Ohio River. The total area of the watershed is about 1027 square miles. During its course, the Mahoning River receives the waters of a number of tributaries, the largest of which are the West Fork of the stream, Eagle Creek, Mosquito Creek, Meander Creek, Mill Creek, and Yellow Creek.

On the watershed of the stream there is a population of approximately 169,000, of which 45,500 is rural and 123,500 urban. The total population per square mile is 138 and the rural population 37. The river is used as a source of water supply for a population of about 100,000, and it supports many large industrial establishments, particularly on the lower reaches. At the present time it is estimated roughly that the sewage of a total population of 93,000 is directly discharged into the river or into its tributaries a short distance from the main stream, within the state of Ohio. This figure includes the sewage of Alliance, which is but little purified by the plant at present in use. While the self-purifying powers of the stream are quite pronounced in some ways, it is true, however, that the river is very grossly polluted by both domestic sewage and manufactural wastes, especially below the principal centers of population.

The stream is so important from an industrial and economic standpoint, and along its shores there are so many interrelated problems of water supply and sewage disposal, that the State Board of Health deemed it advisable to obtain specific information as to the sources of pollution, their effect, and the general character of the waters of the stream at different points, at different stages, and at different seasons of the year. With this information at hand, it was considered that it would be readily possible to draw equitable conclusions as to the course to be pursued with reference to the solution of the many interrelated water supply and sewage disposal problems on the Mahoning River.

The investigation was begun in the early summer of 1908 and was continued until the late winter of 1909. To obtain the desired information as to the quality of the river water and the pollution that enters it at different points, special examinations were conducted in the field; samples of the river water, of sewage, and of manufactural wastes were collected at different points. Below the larger cities and in general at points where considerable pollution enters continuously, samples were collected at approximately equal time intervals over a period of twenty-four hours with a view to obtaining information as to the variation in the quality of the river water during a period of one day.

The field work incidental to the investigation was carried out by two of the assistant engineers, assisted by a member of the laboratory department. There were made three field examinations, the first in the summer, the second in the fall of 1908, and the third in the winter of 1909. The first examination developed information as to the conditions under moderate dry weather and summer heat; the second, conditions under extreme low water; and the third, those under a normal flood and in cold weather.

The above examinations were preceded by a preliminary inspection and were followed by a final inspection, the former to locate points at which samples would be advantageously collected, and the latter to obtain information chiefly of a statistical character and necessary to present a final report. The field work entailed, in addition to the analytical work, the establishment of two gauging stations and measurements of the flow of the river at different points. The majority of the chemical and bacterial data were obtained from analyses made in the field by the aid of a portable kit. Work in the field was supplemented by office work in the preparation of a watershed map, the compilation of population data, and the preparation of the final report, and such necessary analyses made in the laboratory as it was impracticable to make in the field.

In this general summary, it is purposed to review briefly the salient features which have been brought out by the investigation, and to refer in particular to the important special problems which relate to the disposal of the sewage of the communities on the Mahoning River in their relation to public water supplies derived from the stream below these points.

Volume of Flow.

In the fall of 1908, there was an extended period during which there fell little or no rain, and the result of this condition was lower water in the river at a number of points than has perhaps ever been noted within the memory of the oldest inhabitants. All of the smaller streams flowing into the river and some of the larger tributaries were practically dry. Of course during this period, conditions locally were most unfavorable in many repects for the disposal of the filth and refuse poured into the stream.

The field examination made during this very dry period afforded very valuable information as to the actual pollution of the stream during periods of remarkably low flow.

Measurements at Alliance indicated the minimum flow of the river to be about 3,600,000 gallons in twenty-four hours, hardly sufficient to supply the city with water. Measurements made at Leavittsburg during this period showed a flow of 4,600,000 gallons in twenty-four hours. At Youngstown it is estimated that the volume of water available at the intake of the water works was about 15,000,000 gallons. Similarly, at Lowellville, float measurements of the stream showed about 10,000,000 gallons in twenty-four hours, not including considerable water which passed directly into the gravel in the bed of the river. It is interesting to compare this figure with the flow of 1,295,000,000 gallons in twenty-four hours measured at Lowellville with the current meter on February 19, 1909.

The volume of flow at different points on the stream has been recorded for each examination, and these measurements serve in a general way to indicate the relative dilution of the pollution as reflected by the analytical data secured on the three examinations. From the data obtained at the gauging stations at Alliance and Leavittsburg, it appears that at the former station for a period of 67 days beginning September 1, 1908, the rise in the river was not more than 6 inches; also at the latter station for a period of one hundred and thirty-five days beginning August 22, 1908.

The extent of this dry period is very apparent.

Sources of Pollution and Effect on River as Shown by Results of Field Examinations.

The sources of pollution of the river were specially investigated with reference to their effect upon the stream, upon the health and comfort of persons residing on its banks, and with particular reference to public water supplies derived from the river below points at which pollution enters.

The important points at or below which specific pollution enters the river are as follows: Sebring, East Alliance, Alliance, Warren, Niles, Girard, Briar Hill, intake Youngstown water works, Haselton bridge, Struthers, and Lowellville.

Sebring. The village of Sebring has a population estimated at 2000 and is in Mahoning County about two miles east of Alliance. The village has a public water supply and a partial system of sanitary sewers. The sewage flows untreated into Sulphur Creek, which empties into Fish Creek, which is tributary to the Mahoning River. The waters of Sulphur Creek are derived from an abandoned coal mine and are typical acid iron bearing mine wastes. They coagulate the Sebring sewage and the sedimentation afforded by the shallow pools present in dry weather below the confluence of the sewage and the creek, removes the organic matters to a substantial degree. The bacterial data, however, show that some pollution enters the Mahoning River due to the Sebring sewage, and hence this sewage is a menace to the public water supply at Alliance. Furthermore, at times of sharp local rains, the precipitated masses of organic material are swept onward into the Mahoning River.

While conditions at Sebring are such that no public nuisance is produced, the sawage of the village should be treated in such a manner as to remove all offensiveness before its discharge into Sulphur Creek.

East Alliance. Above Alliance the river is polluted by a number of small streams and storm sewers located in East Alliance and in part within the city of Alliance itself. These streams do not afford appreciable visible pollution, but they introduce large numbers of bacteria and constitute a serious menace to the Alliance water supply. All of the three field examinations showed the Mahoning River above Alliance to be considerably polluted and unfit for drinking purposes.

Alliance. Below Alliance the river receives very gross pollution from the clarified sewage of the city. Out of a total population of 14,850, about 6,500 persons are connected with the sewers. On the first two examinations, conditions at Alliance showed a marked public nuisance. On the third examination, the flow of the river was so great that the clarified sewage was satisfactorily disposed of by dilution. The visible pollution practically disappears after a flow of about 8 miles. Of course, the bacterial pollution is not removed, although the bacteria are greatly reduced in numbers. This remarkable self-purification is perhaps explained by the presence of numerous pools and riffles during lower stages of the river.

At Newton Falls, distant about 22 miles by river, no evidence was obtained to indicate the gross pollution at Alliance save for the bacterial data which, however, indicated no greater pollution than true of the West Fork of the river at Newton Falls, a stream which is subject merely to the usual rural pollution.

Conditions at Alliance for the past few years have been such as to cause a marked public nuisance. Acting under the Bense Act, on a petition received from the trustees of a township near the present sewer outfall at Alliance, the Board ordered the installation of a sewage purification plant. Plans have been prepared and it is understood that the construction of this plant will be undertaken shortly.

Newton Falls to Warren. Between Newton Falls and Warren there enters very little pollution of importance. Just below Newton Falls there enters the West Fork of the river; at a short distance above Leavittsburg, Eagle Creek; and about one mile above the Warren water works, Young's Run, which receives the treated sewage from the Trumbull County Infirmary. Wastes from a small creamery at Newton Falls, from a stock farm, and from one or two points in Leavittsburg, are of but slight significance. The investigation has indicated that the water in the Mahoning River at the intake of the Warren water works is always polluted to such an extent that should not be used directly for drinking purposes. Analyses of the purified sewage from the county infirmary and of the water in Young's Run at the Mahoning Road near Warren, collected on the first two examinations, showed very satisfactory purification of sewage on the one hand, and suggested that the water of Young's Run contains no more pollution than is usually present in the Mahoning River above the point at which the run enters.

Below Warren. At Warren begins the pollution of the lower river by domestic sewage, and below Niles by manufactural wastes. At Warren it is conservatively estimated that the sewage of about 7000 people is discharged into the river. This sewage receives no purification and as this investigation has shown, causes marked pollution but does not in itself create a public nuisance at the sewer outfalls. Large numbers of bacteria are present in the river water at Niles and these are very readily traceable to the Warren sewage.

The State Board of Health has quite recently refused to permit the construction of further sanitary sewers at Warren unless there be provided a plant for the purification of the sewage. Plans are in preparation for the construction of such a plant.

Below Niles. At Niles the polluted river water receives the unpurified sewage of about 3200 people inclusive of sanitary wastes from industrial concerns. It further receives considerable volumes of acid iron wastes. The pollution which enters at this point is partially offset during the spring and fall by the dilution afforded by Mosquito Creek from the north and Meander Creek from the south. During dry weather, when the effect of the pollution is at a maximum, the flow of these two creeks is very small and they afforded very little dilution. Furthermore, Mosquito Creek within the city of Niles is very grossly polluted by the sanitary sewage of that city.

Conditions in the main river at Niles are improved by the fact that the pond formed by the Girard dam affords opportunity for considerable of the polluting material to settle to the bottom of the river.

On the first two examinations, that is, during moderate and extreme dry weather, there was no marked public nuisance in the main river below Niles, although the bacterial analyses, especially indicated very highly polluted water.

It is apparent, however, that this pollution added at Niles, and the deposition of sewage matters above the Girard dam are decidedly objectionable features and should be remedied in view of the fact that they tend to increase the pollution of the river at the Youngstown filter plant.

It is important to note that the acid iron wastes discharged into the river at three points in and below Niles have a marked beneficial effect upon the water by furnishing a natural coagulant which entrains the masses of organic matter and temporarily clarifies the stream. This is virtually the process of chemical precipitation so widely practiced formerly in the treatment of domestic sewage. The discharge of these wastes is most unsightly. To improve the appearance of the river with respect to these iron wastes, it would be advisable were the wastes caused to flow into the river at a definite rate throughout the twenty-four hours rather than to be discharged in relatively large volumes once or twice each day, as is oftentimes the case. Copperas recovery from these wastes should be given consideration.

The marked pollution of the Mahoning River below Niles and its relation to the source of water supply of Youngstown has for sometime been recognized by the State Board of Health which in 1908 refused permission for the construction of additional sanitary sewers discharging into the Mahoning River unless the sewage be first treated in a sewage purification plant. Plans for such plant have been prepared and have been accepted by the Board, but to date the plant has not been constructed.

Conditions at Niles and in particular the marked nuisance in Mosquito Creek caused by the sewage of the city, demand a sewage purification plant, and it is probable that a plant will be constructed in the near future. Of considerable importance in this connection is the probable future growth of the city of Niles. There appears to be every probability of the establishment this year (1909) of several large industrial plants, which will employ a comparatively large force of men.

Another source of pollution between Niles and Girard is sewage from a leather works located on the shores of Squaw Creek. The tannery sewage which consists of spent dehairing liquor, spent dye liquor, and spent tanning liquor, discharges into Squaw Creek at a point about 1000 feet from the mouth of the creek. These wastes are in considerable volume and contain such relatively large quantities of organic matter as to create very offensive odors during dry weather, and when undiluted by water in Squaw Creek. During dry weather this small tributary is practically dry and hence the wastes create very offensive conditions. Certain other objectionable refuse material is discharged from the plant and is eventually a source of pollution of the Mahoning River.

Below Girard. At least during the first two examinations the water at Girard showed a fairly good organic quality, largely no doubt due to the agencies of purification previously discussed. Notwithstanding its considerable purification, however, the river water in low stages still contains evidences of contamination and could in no sense be considered satisfactory for drinking purposes without purification.

The village of Girard itself as yet has no public water supply and the sanitary sewers already constructed are but little used. There are one or two industrial plants between Girard and Briar Hill, but their wastes do not have a very pronounced effect upon the character of the river water. There are several pools and riffles in the river between Girard and Briar Hill, and in dry weather the sedimentation and aeration thus afforded somewhat improves the quality of the river water.

Briar Hill to Intake Youngstown Water Works. Between Briar

Hill and the intake of the Youngstown water works is a densely populated territory which has no public water supply and no sanitary sewerage system. As data obtained during this investigation indicate, and from results of previous studies by the Board, at times of sharp local showers very decided pollution enters the river owing to the drainage from this territory. The mud carried by the river, the total numbers of bacteria and organisms specially indicative of sewage, show very large increases, and thus at such times overshadow the pollution ever present in the river and derived from polluting material introduced at points above.

The appearance of the river between Briar Hill and the Youngstown water works is frequently very unsightly in view of the vast quantities of ore dust which float upon the surface of the water. The river is a series of ponds formed by low dams built for the purpose of supplying water for use in the steel mills. The volume of water used for cooling purposes is very great and is strikingly shown by the unusually high temperature of the river water.

Below the outlets of these large industrial plant drains there form large slimy deposits, and the water has an oily odor and is usually covered with a thin film of oil. The water in the Mahoning River at the Youngstown water works is of course entirely unfit for drinking purposes in a raw state.

Youngstown Water Works and Haselton Bridge. Between the intake of the Youngstown water works and Haselton bridge there enters all the sewage and drainage from the city of Youngstown and water from the steel mills. The estimated population sewering directly or indirectly into the river is 67,000. Conditions below Haselton bridge during the low water of the second examination were very foul. The flow of the river was very largely composed of the sewage of Youngstown since that part of the stream not pumped to the filter plant was in large part being temporarily conserved by the mills above Haselton. The river water had a very foul odor and was entirely devoid of oxygen and hence was incapable of supporting fish life. Conditions were not nearly so pronounced on the first examination since there was greater dilution under the somewhat higher river flow which then prevailed. It is interesting to note that the temperature of the river water at Haselton is usually very high comparatively speaking, owing to the large volume of cooling waters used by the steel mills. It is evident that the direct disposal of the Youngstown sewage into the Mahoning River is very unsatisfactory, since the increase in population of the city has exceeded the powers of the stream satisfactorily and inoffensively to dispose of its sewage by dilution alone.

It is very interesting to compare these conditions with those which existed during the examination of the river made ten years ago in 1898. (See appendix.) At that time only about 10,000 persons were connected to the Youngstown sewers, and although considerable objectionable drainage entered the stream, the pollution of the river was not specially pronounced. The changed conditions at the present time are attributable both to the very rapid growth of the city, the extension of the water mains and sewerage system, and a rapid development of industrial plants.

Haselton to Struthers. During the extreme drought in the fall of 1908, at a point about one and one-half miles below Haselton, the foul river water received a considerable volume of acid iron wastes or spent pickle, sewage, cooling waters, and other wastes from a large steel plant which employs about 5500 men and extends along the river front for approximately one mile. The daily consumption of water at this plant is from 40,000,000 to 50,000,000 gallons. The effect of these acid iron wastes was to impart to the stream a brick red color which is visible practically to the dam at Struthers. The acid iron wastes rapidly coagulated upon entering the stream, thereby precipitating considerable of the filth introduced by the Youngstown sewage. The pool above the Struthers dam then partially completed what is virtually the well konwn process of chemical precipitation as applied to sewage in the early days of sewage treatment and as now used at Alliance.

The condition of the river at Struthers is thus similar to that between Niles and Girard, only that at Struthers the much greater volume of putrescent material present in the water renders the clarification much less effective. During the extreme low water in the fall of 1908, the river at Struthers contained considerable precipitated filth in suspension, the water emitted considerable odor, and in general conditions were very objectionable. It is furthermore important to note that the solid matter precipitated and carried to the bottom of the stream during low water is eventually scoured out under slight rises in the river and thus creates very objectionable conditions. It is apparent that the discharge of the Youngstown sewage into the Mahoning River at very low stages when the water is so carefully conserved by the steel mills, causes conditions which are decidedly obnoxious. Were it not for the acid iron wastes discharged into the stream, a feature over which the city of Youngstown has no control, there would exist at times of very low water a very marked public nuisance. Considering the present rapid growth of the city, future low water conditions below Youngstown will be decidedly more obnoxious than those which prevailed during the investigation, and it is clear that other means for the disposal of the sewage of the city are distinctly desirable and will soon be urgently necessary.

Struthers to Lowellville. The village of Struthers adds to the river but little sanitary sewage. The manufacturing plant above the Struthers dam, however, contributes the sewage of its 125 employees. Immediately below the dam there enters Yellow Creek which carries considerable acid iron wastes from a large rod and wire mill located in Struthers, and some sanitary sewage from the industrial plants below the Struthers dam. The entrance of the Yellow Creek water is readily observed by the marked reddish color of its waters and the deposition of reddish brown masses of iron upon the bottom and banks of the Mahoning River.

The dam at Lowellville backs the water almost to Struthers and the large storage basin thus provided aided by the coagulant introduced in the form of acid iron wastes, affords further opportunity for chemical precipitation and clarification. This investigation has shown that the water below Lowellville is generally well aerated and free from visible organic pollution. A large number of the bacteria introduced in the course of the river through Youngstown have been removed, but the river water is still distinctly polluted and is by no means safe as a source of public water supply. It is furthermore important to mention that after sharp local showers and during rises in the river incidental thereto, large masses of previously deposited polluting material are carried down the river.

Summary. Throughout its course the river receives considerable pollution and it may be said that at no point could its waters be safely used as a public water supply without purification. On the lower river, the water supplies of Warren and Youngstown are derived from the river, and with a view to protecting the source of supply of the latter city it is highly desirable that the volume of putrescent filth, such potent food for bacterial life, shall be eliminated from the stream in so far as practicable. In accomplishing this end, therefore, it is essential that all centers of population should be required at least partially, to purify their sewage before its discharge into the stream. It is true that there are certain natural and artificial agencies at work in the river temporarily to offset the effect of the vast volumes of filth discharged into the stream at different points, but it is clear that the construction of sewage purification plants for all the large communities would greatly improve the character of the water.

At the present time the manufactural wastes discharged into the stream within and below Niles and below Haselton bridge and at the mouth of Yellow Creek, considerably improve the organic condition of the river water in its lower stages but greatly detract from the appearance of the stream and in the advent of the construction of sewage purification plants would cease to be of material benefit in the improvement of the river water. Especially during low stages of the river, the acid iron wastes cause a marked deterioration in the chemical quality of the river water, a fact which is indicated particularly by the increase in incrustants in the river in its course through the state. Attention should be directed to the question of the recovery of copperas from these wastes, and in case this plan is not practical nor feasible, the marked aesthetic pollution produced by these pickling liquors should be minimized by causing them to flow into the river continuously and in equal volumes throughout the twenty-four hours and not in large volumes and at long intervals.

Some steps should be taken to abate the marked nuisance in Squaw Creek above Girard. Purification of these tannery wastes should be considered.

Pollution of the River With Reference to Public Water Supplies Derived Therefrom.

As has been mentioned, a population of about 100,000 is dependent upon the Mahoning River for drinking water. This includes the surface supply of the city of Sebring, the impounded supply of Alliance, and the surface filtered supplies of Warren and Youngstown. The important relation of these water supplies to the pollution of the river will now be briefly reviewed.

Sebring. The village of Sebring consumes about 125,000 gallons of water daily, which is derived from the main branch of the Mahoning River at a point about three miles above Alliance. After slight storage in a standpipe, the water is delivered directly to the consumers. During this investigation the water supply of Sebring was found to contain evidences of pollution. The muddiness of the water is at times very marked and the presence of considerable numbers of bacteria and intestinal organisms suggest that a mechanical filter plant should be provided or that water should be secured from another source.

Alliance. The water supply of Alliance is obtained by impounding the Mahoning River at a point a short distance above the city limits. From the dam the water flows into a sedimentation canal which affords about one day's storage. The daily pumpage is about 3,137,000 gallons.

The data obtained during this investigation show that the Mahoning River above Alliance is polluted by surface drainage from East Alliance and by the sewage of Sebring, and indications are strong that even after impounding, the unpurified Mahoning River water is not a safe nor a satisfactory supply for Alliance. Furthermore, during very low water there is barely sufficient water available for the needs of the city. Alliance is increasing so rapidly in population that it is evident that additional sources of water supply must soon be secured. The recent investigation has shown not only the scarcity of water during dry weather, but also that the present supply is not satisfactory and not safe. The evidence indicates the desirability of obtaining a more abundant supply and one of better quality.

Warren. Warren with a population of from 10,000 to 12,000, obtains water from the Mahoning River subsequent to its purification in a mechanical filter plant. The Mahoning River at the intake of the Warren water works is always slightly polluted, is very muddy at times of storms, and would be entirely unsafe and unsatisfactory for use without filtration. The recent investigation and other special studies of the Board have shown that the water supply of Warren is very satisfactory. The filter plant, which is one of the oldest mechanical plants in the country, thoroughly purifies the polluted Mahoning River water and furnishes ample protection to the consumers. The filtered water is clear and potable, as is evident by the general absence of typhoid fever in the city and as well from the results of analyses made during this and previous investigations of the State Board of Health. The daily water consumption in Warren is about 850,000 gallons (1908).

Niles. The water supply of Niles is derived chiefly from a system of 11 wells driven from 45 to 65 feet to waterbearing gravel on several acres of land adjoining the Mahoning River and about 1000 feet south of Main Street. In addition, there is a large dug well 17 feet in diameter and 70 feet deep. Water is raised from the small wells by air lifts and discharges into the large well, from which it is pumped into the distribution system. A 500,000 gallon brick tank serves as an equalizing reservoir, but there is no adequate storage.

Some years ago there was built an emergency intake in the Mahoning River. During fires it is necessary to supplement the well with river water. This practice seriously pollutes the supply and as investigation shows, evidences of contamination by the polluted river water are noticeable in the mains for a considerable time after the river water is shut off. The attention of the Niles officials was called by the State Board of Health to the dangerous character of its water supply, and in February of this year (1909) the local officials advised the citizens by newspaper notices not to drink the water unless it was first boiled. Since that time it is stated that no river water has been pumped.

In view of these facts, it is apparent that something should be done to supplement the well supply in order to make unnecessary the use of the raw Mahoning River water. The emergency intake should either be abandoned or the valve which controls it should be locked and the key kept at the office of the board of health. On the ground of economy, changes in the arrangement of the wells are distinctly desirable. Under present conditions, this water supply may be at times badly polluted, is then a marked danger and menace to the health of the city as has been shown by fairly severe outbreaks of typhoid fever in years past and in an epidemic of intestinal troubles which occurred in the early spring of this year. The question of the development of a larger water supply is now under consideration by the Niles officials.

Youngstown. Perhaps the most important problem upon which information was desired in this investigation is the relation of the sewage poured into the river above Youngstown to the water supply of that city. The city of Youngstown with a population of 75,000, in 1908 pumped from the river daily 6,612,000 gallons of water. Present consumption (July, 1909) is about 7.200,000 gallons daily. Until the year 1905 this water was taken directly from the river without purification. Since that time the Mahoning River water has been purified by a mechanical filter plant of 10,000,000 gallons capacity. During this and a previous investigation by the Board, special studies have been directed toward the efficiency of the Youngstown filter plant in the purification of the polluted Mahoning River water at the intake of the plant. In general, the investigation has indicated that the efficiency of the plant is generally high and that the filtered water is safe and very satisfactory, as is of course further shown by the comparative absence of typhoid in those sections of the city using the filtered water.

The investigation has developed also that after sharp local rains, the Mahoning River water at the intake of the water works is so polluted by filth derived from the thickly populated territory north of the intake that only by the most careful operation is it possible for the filter plant to produce a satisfactory water. In other words, the load on the filter plant is very excessive at such times, and the pollution is so great that a point is almost reached where it is not practicable to produce an entirely satisfactory water with the means at hand.

This feature is of marked interest in view of the proposed plan of impounding one of the tributaries of the Mahoning River in Berlin Township with a view to providing a fixed minimum flow in the river. This investigation indicates that in view of the present pollution which enters the river a short distance above the intake, this conservation plan would not be fully satisfactory unless changes were made in the present water works plant. It is true, of course, that more water would be available for dilution, but it is also probable that this feature would be offset by the rapid development of manufacturing plants above the water works intake and above Briar Hill.

In view of these considerations, and further, because of the limited flow of the Mahoning River during very dry weather, the considerable yearly increase in water consumption and the near approach to the ultimate capacity of the plant, it is apparent that the water supply problem at Youngstown is a very important and, in fact, a serious question.

Upon weighing the evidence obtained during this investigation, several separate plans suggest themselves, any one of which would materially improve present conditions:

1. That a public water supply and a system of sanitary sewers be provided for the extended area immediately above the present intake, with an outlet for the sewers below the intake;

2. That the intake be removed to a point on the river above Briar Hill;

3. That the intake be continued as at present with provisions for applying sterilizing agents to the settled water whenever the river is very grossly polluted as now occurs after sharp local rains; or

4. That a water supply be obtained from a source other than the Mahoning River.

CONCLUSIONS.

This investigation has shown that the Mahoning River is very grossly polluted at many points in its course, and particularly below points of maximum population density. Practically none of the sewage which enters the stream is purified to the point of non-offensiveness. While the river water is used by a large number of people for drinking purposes, it is true that on no point of the stream is the water satisfactory for domestic consumption in its raw state. Filtration is requisite to remove both mud and bacteria.

At low stages, public nuisances in the river exist at Alliance and Youngstown, and in Mosquito Creek at Niles; that at Alliance will soon be eliminated by the installation of a sewage purification plant. Conditions below Youngstown indicate the necessity for attention in the near future to the problem of the disposal of the sewage of that city, especially since the present serious conditions during low water will be greatly aggravated before a sewage plant can be built in view of the very rapidly increasing population of the city.

Local problems of special importance are a better water supply for the city of Alliance; the purification of the Alliance sewage; the purification of the Warren sewage; the enlargement and improvement of the Niles water supply; the purification of the Niles sewage; the development of a more abundant water supply for Youngstown; and the purification of the Youngstown sewage.

In conclusion, it is clear that the desired results in cleaning up the Mahoning River can best be accomplished by the united and co-operative effort of the cities and villages along the stream with the State Board of Health. It is hoped that the above discussion as reflecting the important features brought out by the recent investigation of the Mahoning River by the Board will awaken responsive public sentiment in carrying out a work which will be of marked benefit to the health and comfort of all of the communities along the Mahoning River valley.

APPENDIX.

ANALYSES OF MAHONING RIVER WATER INVESTIGATION OF 1898.

(PARTS PER MILLION.)

Source.	Date 1898.	Oxygen Consumed.	Nitrogen as					Dis. Oxygen Per cent. Saturation.	Temp. °F.	Bacteria per c.c.
			Alb. Ammonia.	Free Am'onia.	Chlorine.	Alkalinity.	Incrustants.			
Above Warren.	6/18	6.2	0.32	.05	2.0	92	16	....	....	815
Above Warren.	7/23	14.7	0.51	.13	0.3	36	22	68	73	5,980
Above Warren.	8/28	6.9	0.28	.05	3.5	100	28	99	74	155
Above Warren.	9/30	4.4	0.15	.03	4.2	124	32	90	61	165
Above Warren.	10/28	3.8	0.13	.02	3.7	140	14	82	55	540
Above Warren.	11/27	9.8	0.36	.06	3.3	54	46	83	45	5.720
Below Warren.	6/18	6.4	0.32	.10	4.0	102	24	....	....	1,460
Below Warren.	7/23	15.4	0.52	.12	0.3	34	18	76	73	14,800
Below Warren.	8/28	7.1	0.31	.11	4.5	100	26	66	73	1.240
Below Warren.	9/30	4.7	0.17	.06	4.5	124	12	72	61	7,700
Below Warren.	10/28	4.5	0.22	.20	6.2	140	3.0	54	57	7,140
Below Warren.	11/27	11.2	0.43	.08	3.3	54	42	90	46	14.900
Niles	7/24	14.3	0.45	.17	2.1	40	36	70	73	3,800
Niles	8/28	7.1	0.35	.08	4.5	90	26	92	71	445
Niles	9/30	4.3	0.16	.06	8.7	126	18	89	59	305
Niles	10/28	5.1	0.25	.08	42.5	138	30	70	55	600
Niles	11/27	9.7	0.37	.08	5.0	56	56	81	46	7,860
Above Girard..	7/18	9.2	0.38	.06	5.8	76	32	....	....	1,000
Above Y'ngst'n.	6/18	9.3	0.35	.08	5.3	90	28	....	....	2.250
Above Y'ngst'n.	7/23	16.8	0.59	.10	0.3	22	20	86	71	14.200
Above Y'ngst'n.	8/28	10.4	0.36	.09	4.0	56	24	82	79	575
Above Y'ngst'n.	9/30	4.0	0.16	.05	13.5	88	86	93	69	1.160
Above Y'ngst'n.	10/28	4.3	0.16	.04	15.2	106	66	76	61	2.630
Above Y'ngst'n.	11/27	8.5	0.32	.08	5.0	64	54	90	45	5,530
Haselton bridge	6/18	8.3	0.36	.14	7.0	96	28	....	....	2,400
Haselton bridge	7/23	19.4	0.75	.10	0.5	26	38	72	71	12,400
Haselton bridge	8/28	10.6	0.38	.18	6.5	64	28	66	79	5.160
Haselton bridge	9/30	5.2	0.22	.19	18.0	114	70	77	72	6,350
Haselton bridge	10/28	5.5	0.37	.62	25.2	130	78	51	64	30,500
Haselton bridge	11/27	10.2	0.38	.12	5.7	52	58	84	45	13.200

REPORT ON INVESTIGATION OF THE MAHONING RIVER.

RESULTS OF FIELD ANALYSES—FIRST EXAMINATION.

(PARTS PER MILLION.)

Sulphur Creek and Mahoning River at Sebring.

No. of Samp.	Date. 1908.	Time.	Bacteria Per C. C.	Coli.		Color.	Turbidity.	Alkalinity.	Free	Temp.	Dissolved Oxygen.		Odor
				Present In C. C.	Absent In C. C.				CO$_2$	Deg. C.	Pts. Per Mil.	% Sat.	
	July												
S-1	14	12.30 P..	4	....	3.0	20	20	*	......	....	0.9	......	0
S-2	14	2 P..	340,000	....	....	......	......	220	40	....	0	0	5 H$_2$S
S-3	14	3.15 P..	280,000	....	....	......	......	......	......	....	0	0	5 H$_2$S
S-4	14	4 P..	2,000	....	1.0	......	5	*	......	....	0	......	4 D
S-5	14	5.10 P..	1,700	0.5	0.2	......	20	*	......	....	6.6	......	2 V
S-6	15	10 A..	300	0.2	0.1	20	58	154	3	....	7.4	......	2 V
S-7	15	10.30 A..	880	0.2	0.1	20	52	90	2.5	....	10.0	......	2 V
S-8	15	11 A..	225	0.5	0.2	23	30	148	5	....	3.6	......	1 V

Sources of Samples.

S-1 Sulphur Creek above confluence with sewage.
S-2 Sebring crude sewage.
S-3 Sulphur Creek, 150 ft. below confluence with sewage.
S-4 Sulphur Creek, 1 mile below confluence with sewage.
S-5 Sulphur Creek, 2.5 miles below confluence with sewage.
S-6 Mahoning River, from pumping station Sebring water works.
S-7 Creek receiving cellar drainage of Sebring.
S-8 Sebring public water supply, from tap at office of H. R. Ewing.

*S-1 Acidity to methyl orange 98; to phenol 1400.
*S-2 Acidity to methyl orange 76; to phenol 263.
*S-5 Acidity to methyl orange 58; to phenol 470.

Filtered water, tap in laboratory Warren water works.

No. of Samp.	Date. 1909.	Time.	Bacteria Per C. C.	Coli.		Color.	Turbidity.	Alkalinity.	Free	Temp.	Dissolved Oxygen.		Odor
				Present In C. C.	Absent In C. C.				CO$_2$	Deg. C.	Pts. Per Mil.	% Sat.	
W-45	21	9 A..	125	....	50	4	0	73	22	24.0	4.5	53	0
W-56	21	3 P..	185	....	50	5	0	73	18	24.0	4.3	51	0
W-58	21	9 P..	225	....	50	5	0	71	26	24.0	4.6	54	0
W-59	22	7 A..	135	....	50	5	0	70	25	23.0	4.4	51	0
Warren water supply, tap at Park Hotel.													
W-57	21	2 P..	70	....	50	5	0	76	14	....	3.1	37±	0

RESULTS OF FIELD ANALYSES. — Continued.

Mahoning River, above Alliance, below Fish Creek.

No. of Samp.	Date. 1908.	Time.	Bacteria Per C. C.	Coli.		Color.	Turbidity.	Alkalinity.	Free	Temp.	Dissolved Oxygen.		Odor
				Present In C. C.	Absent In C. C.				CO$_2$	Deg. C.	Pts. Per Mil.	% Sat.	
	July												
A-20	14	5 P..	520	0.1	.05	15	35	152	5	....	6.9	......	1 E
A-21	14	10.30 P..	390	0.3	....	18	......	136	4	....	6.2	......	1 E
A-22	15	6.30 A..	125	0.3	....	15	......	134	4	....	5.9	......	1 E
A-23	15	11 A..	290	1.0	.3	18	75	132	3	....	5.7	......	1 E
Mahoning River, above Alliance and above Fish Creek.													
A-24	15	11.30 A..	325	0.3	....	20	75	136	3	....	5.7	......	1 E
Sewage at Alliance outfall.													
A-29	14	5 P..	220,000	.0005	....	15	85	186	7	22.5	4 0	51	5 V
A-30	14	11 P..	210,000	....	....	15	......	188	—16	18.0	5.8	60	5 V
A-31	15	8 A..	320,000	.001	.0005	15	......	194	—8	20.0	1.9	21	5 V
A-32	15	11 A..	252,000	.001	.0005	15	......	214	—34	21.0	1.6	18	5 V
Mahoning River, 500 ft. below outfall.													
A-33	14	5 P..	70,000	....	....	15	48	174	10	25.0	6.7	80	4 V
A-34	14	11 P..	80,000	....	....	15	40	164	—2	21.0	5.6	62	4 V
A-35	15	8 A..	115,000	....	....	15	35	194	14	23.0	4.9	57	4 V
A-36	15	11 A..	76,000	0.2	....	15	40	188	—13	23.0	4.4	51	4 V
Tap near pump, Alliance water works.													
A-37	15	3.30 P..	200	0.2	0.1	30	7	164	3	25.0	8.0	96	2 V
Below Alliance: No. 1, 3.5 miles below; No. 2, 6 miles, and No. 3, 8 miles below.													
1	17	8 A..	1,500	3.0	....	10	45	183	2	....	4.4	45±	1 M
2	17	9 A..	925	3.0	....	12	55	173	1.5	....	5.3	54±	1 Sew
3	17	10 A..	425	3.0	....	13	25	153	2	....	8.5	86±	1 E
East Fork of river at Newton Falls.*													
N-40	17	12 M..	560	3.0	....	15	28	136	4	16.7	8.0	81	1 E
N-41	17	6 P..	14,000	3.0	....	15	40	122	6	16.1	6.5	66	1 E
N-42	18	8 A..	1,100	3.0	....	12	55	126	4	16.1	6.2	63	1 E
West Fork of river at Newton Falls.													
N-45	17	12 M..	1,700	3.0	....	15	150	88	4	16.7	7.8	79	1 E
N-46	17	6 P..	1,800	3.0	....	18	170	86	4	16.1	6.1	62	1 E
N-47	18	8 A..	5,000	....	3.0	20	130	83	6	16.1	6.4	65	1 E
Mahoning River, below confluence at Newton Falls.													
N-50	17	12 M..	1,800	3.0	....	25	55	118	4	16.7	8.1	82	1 E
N-51	17	6 P..	1,700	3.0	....	20	75	108	4	16.1	7.0	71	1 E
N-52	18	8 A..	6,700	....	3.0	20	75	118	3	16.1	6.5	66	1 E
Mahoning River, at intake of Warren water works.													
W-50	21	9 A..	3,000	0.5	0.1	25	90	84	6.0	24.0	4.6	54	1 E
W-51	21	3 P..	5,500	0.1	....	25	95	84	5.0	24.0	5.0	59	1 E
W-52	21	9 P..	2,500	0.1	....	25	80	84	2.0	24.0	5.6	66	1 E
W-53	22	7 A..	1,500	0.5	0.1	25	75	83	7.0	23.0	4.5	52	1 E

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* Heavy shower on watershed starting about noon, July 17.

RESULTS OF FIELD ANALYSES. — Continued.

Mahoning River, 600 ft. below Warren sewers.

No. of Samp.	Date. 1908.	Time.	Bacteria Per C. C.	Coli.		Color.	Turbidity.	Alkalinity.	Free	Temp.	Dissolved Oxygen.		Odor
				Present In C. C.	Absent In C. C.				CO$_2$	Deg. C.	Pts. Per Mil.	% Sat.	
W-60	21	9 A..	485,000	.001	....	21	45	106	8.0	22.2	5.3	60	3 Sew
W-61	21	3 P..	85,000	.005	.001	25	350	122	6.0	21.1	7.5	83	2 Sew
W-62	21	9 P..	376,000	.001	....	25	160	92	6.0	21.7	5.7	65	2 Sew
W-63	22	8 A..	25,000	.001	....	25	70	92	6.0	21.1	6.8	76	3 Sew
W-66 (1)..	20	3 P..	6,700	1.0	....	30	100	68	4.0	20.0	5.4	59	2 V
W-67 (2)..	20	3 P..	9,000	1.0	....	26	80	76	6.0	20.0	5.4	59	2 V
W-64 (3)..	22	3 P..	55,000	0.1	....	8	5-	52	25	21.1	.8	9	0
W-65 (4)..	22	4 P..	1,100	....	....	13	45	68	0	27.8	7.3	94	0

Sources of Samples.

(1) W-66 Eagle Creek, at junction with Mahoning River.
(2) W-67 Mahoning River, below Eagle Creek.
(3) W-64 Effluent from sewage purification plant, Trumbull Co. infirmary.
(4) W-65 Young's Run, near Mahoning Avenue.

Mahoning River, above Niles near water works station.

No. of Samp.	Date. 1908.	Time.	Bacteria Per C. C.	Coli.		Color.	Turbidity.	Alkalinity.	Free	Temp.	Dissolved Oxygen.		Odor
				Present In C. C.	Absent In C. C.				CO$_2$	Deg. C.	Pts. Per Mil.	% Sat.	
N-70	July 23	3 P..	310,000	.001	....	25	55	70	3	24	5.7	67	2 E
N-71	23	9.30 P..	85,000	.005	.001	25	50	102	6	23	5.8	67	2 E
N-72	24	7.30 A..	280,000	.005	.001	25	90	82	4	23	5.7	66	2 E
N-73	24	3 P..	1,900,000	.03	.005	30	100	76	3	23.5	3.6	42	2 E

Niles water supply, tap at Allison Hotel.

No. of Samp.	Date. 1908.	Time.	Bacteria Per C. C.	Present In C. C.	Absent In C. C.	Color.	Turbidity.	Alkalinity.	CO$_2$	Deg. C.	Pts. Per Mil.	% Sat.	Odor
N-74	24	3 P..	9	3.0	....	10	10±	186	2	16.1	11.3	......	0

Mahoning R., below Niles, at Erie R. R. bridge.

No. of Samp.	Date. 1908.	Time.	Bacteria Per C. C.	Present In C. C.	Absent In C. C.	Color.	Turbidity.	Alkalinity.	CO$_2$	Deg. C.	Pts. Per Mil.	% Sat.	Odor
N-75	23	3.30 P..	290,000	.005	.002	25	65	90	4	25.0	4.8	57	3 E
N-76	23	9.30 P..	370,000	.5	.03	25	45	88	4	24.4	5.7	68	3 E
N-77	24	8 A..	450,000	.005	.001	25	70	86	4	23.9	5.4	64	2 E
N-78	24	3.30 P..	460,000	.03	.005	30	100	84	3	24.4	4.8	57	......

Mahoning River, below Girard.

No. of Samp.	Date. 1908.	Time.	Bacteria Per C. C.	Present In C. C.	Absent In C. C.	Color.	Turbidity.	Alkalinity.	CO$_2$	Deg. C.	Pts. Per Mil.	% Sat.	Odor
G-80	23	5 P..	1,000,000	.03	.005	30	100	60	4	23.9	6.0	71	2 V
G-81	23	10.30 P..	500,000	.005	.001	30	95	74	4	24.0	6.3	74	3 E
G-82	24	9.15 A..	1,300,000	.5	.03	30	80	78	4	23.5	6.4	74	2 E
N-83 (1)...	24	4 P..	900	.3	....	35	210	76	3	23.9	4.0	47	1 E
N-84 (2)...	24	4 P..	2,000	.3	....	50	30	44	3	26.0	6.3	72	1 E

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(1) N-83 Meander Creek.
(2) N-84 Mosquito Creek.

RESULTS OF FIELD ANALYSES. — Continued.

Mahoning River, above Youngstown at Briar Hill.

No. of Samp.	Date. 1908.	Time.	Bacteria Per C. C.	Coli. Present In C. C.	Coli. Absent In C. C.	Color.	Turbidity.	Alkalinity.	Free CO$_2$	Temp. Deg. C.	Dissolved Oxygen. Pts. Per Mil.	Dissolved Oxygen. % Sat.	Odor
Y-90	July 27	3 P..	95,000	.005	.001	20	35	78	2	26.1	7.1	87	1 E
Y-91	27	9 P..	33,000	....	....	25	35	76	4	25.6	6.4	78	1 E
Y-92	28	8 A..	39,000	.1	.02	25	30	88	3	25.6	7.0	85	1 E
Y-93	28	1 P..	80,000	.02	.005	25	26	78	2	26.7	7.8	97	1 E

Mahoning River, at Youngstown water works.

No. of Samp.	Date. 1908.	Time.	Bacteria Per C. C.	Coli. Present In C. C.	Coli. Absent In C. C.	Color.	Turbidity.	Alkalinity.	Free CO$_2$	Temp. Deg. C.	Dissolved Oxygen. Pts. Per Mil.	Dissolved Oxygen. % Sat.	Odor
Y-95	27	3 P..	17,000	.1	.02	25	40	77	4	27.2	6.2	78	3 E
Y-96	27	9.30 P..	220,000	.005	.001	25	100	79	4	27.8	6.2	79	3 E
Y-97	28	7.30 A..	68,000	.025	.005	27	30	76	4	27.2	7.0	88	3 E
Y-98	28	2 P..	50,000	.1	.025	30	35	75	6	28.3	7.0	89	3 E

Filtered water at Youngstown purification plant.

No. of Samp.	Date. 1908.	Time.	Bacteria Per C. C.	Coli. Present In C. C.	Coli. Absent In C. C.	Color.	Turbidity.	Alkalinity.	Free CO$_2$	Temp. Deg. C.	Dissolved Oxygen. Pts. Per Mil.	Dissolved Oxygen. % Sat.	Odor
Y-100	27	3.30 P..	3,500	....	3.0	4	0	61	12	27.8	......	......	0
Y-101	28	7.30 A..	4,900	1.0	....	4	0	60	12	....	4.0	51±	0
Y-102	28	3 P..	5,900	....	3.0	4	0	62	12	27.8	4.4	56	0

Mahoning River, below Youngstown, 900 ft. below Haselton bridge.

No. of Samp.	Date. 1908.	Time.	Bacteria Per C. C.	Coli. Present In C. C.	Coli. Absent In C. C.	Color.	Turbidity.	Alkalinity.	Free CO$_2$	Temp. Deg. C.	Dissolved Oxygen. Pts. Per Mil.	Dissolved Oxygen. % Sat.	Odor
Y-105	27	4 P..	920,000	.001	....	20	35	98	9	30.6	1.8	24	3 S
Y-106	27	10 P..	1,600,000	.001	....	20	220	86	4	28.3	1.5	19	3 S
Y-107	28	7.30 A..	270,000	.001	....	20	80	90	10	31.1	2.5	34	4 S
Y-108	28	1.30 P..	850,000	.001	....	20	100	90	6	....	2.4	32±	3 S
Y-99 (1)...	29	11 A..	1,700	.5	.1	25	35	85	4	26.0	6.6	81	1 E
Y-109 (2)..	28	2 P..	390,000	.001	....	20	95	112	6	....	2.4	......	4 S
Y-110 (3)..	29	3 P..	440,000	....	.1	25	50	80	4	40.0	5.0	79	3 0
Y-111 (4)..	29	4 P..	150,000	.1	.01	25	50	81	4	39.0	5.7	88	3 0

(1) Y-99 Mill Creek, 300 ft. above Mahoning River.
(2) Y-109 Crab Creek, at junction with Mahoning River.
(3) Y-110 Wastes from Ohio Steel Co., upper plant.
(4) Y-111 Wastes from Ohio Steel Co., lower plant.

Mahoning River above Struthers.

No. of Samp.	Date. 1908.	Time.	Bacteria Per C. C.	Coli. Present In C. C.	Coli. Absent In C. C.	Color.	Turbidity.	Alkalinity.	Free CO$_2$	Temp. Deg. C.	Dissolved Oxygen. Pts. Per Mil.	Dissolved Oxygen. % Sat.	Odor
S-120	July 28	5 P..	145,000	....	....	20	68	96	6	32.2	2.3	31	2 E
S-121	28	10 P..	285,000	.005	.001	15	105	80	12	32.2	1.8	25	Oil
S-122	29	9 A..	180,000	.001	....	20	55	84	12	32.2	2.0	27	2 E
S-123	29	3.30 P..	320,000	.005	.001	20	65	80	14	32.2	2.3	31	2 E

Mahoning River below Struthers. 1200 ft. below main bridge.

No. of Samp.	Date. 1908.	Time.	Bacteria Per C. C.	Coli. Present In C. C.	Coli. Absent In C. C.	Color.	Turbidity.	Alkalinity.	Free CO$_2$	Temp. Deg. C.	Dissolved Oxygen. Pts. Per Mil.	Dissolved Oxygen. % Sat.	Odor
S-125	28	6 P..	98,000	.001	....	20	65	90	6	31.1	2.3	31	3 E
S-126	28	11 P..	225,000	.001	....	20	105	66	12	31.1	3.5	47	......
S-127	29	9 A..	170,000	.001	....	20	35	90	8	31.7	2.2	30	......
S-128	29	5 P..	45,000	.025	.005	20	50	90	10	36.7	2.5	38	......

RESULTS OF FIELD ANALYSES. — Continued.

Mahoning River, 300 ft. below Lowellville dam.

No. of Samp.	Date. 1903.	Time.	Bacteria Per C. C.	Coli.		Color.	Turbidity.	Alkalinity.	Free	Temp.	Dissolved Oxygen.		Odor
				Present In C. C.	Absent In C. C.				CO$_2$	Deg. C.	Pts. Per Mil.	% Sat.	
	July												
L-130	28	5 P..	41,000	.005	....	20	23	90	6	30.0	4.4	58	3 F
L-131	28	10.30 P..	29,000	.025	.001	20	23	86	6	30.0	4.4	47	3 F
L-132	29	9 A..	60,000	.005	.001	20	22	86	8	28.0	3.9	49	3 F
L-133	29	2.30 P..	21,000	.025	.005	35	35	86	6	32.2	5.1	70	3 F
S-140 (1)..	29	3 P..	355	....	50	25	25-	68	6	21.7	1.1	12	......
S-141 (2)..	29	3.20 P..	7,700	.1	....	20	50	90	14	54.4	4.6	......	......
S-142 (3)..	29	4.30 P..	15,000	....	1.0	20	140	14	40	33.9	2.4	34	......
S-143 (4)..	29	6 P..	28,000	.1	....	10	50	90	8	46.1	5.4	......	......

Sources of Samples.

(1) S-140 Struthers water supply, tap at office of Struthers Furnace Co.
(2) S-141 Drain from Struthers Furnace Co.
(3) S-142 Yellow Creek at mouth.
(4) Y-143 Drain from sheet mill of the Youngstown Sheet & Tube Co.

RESULTS OF FIELD ANALYSES—DURING SECOND EXAMINATION.

No. of Samp.	Date. 1908.	Time.	Bacteria Per C. C.	Coli.		Color.	Turbidity.	Alkalinity.	Free	Temp.	Dissolved Oxygen.		Odor
				Present In C. C.	Absent In C. C.				CO$_2$	Deg. C.	Pts. Per Mil.	% Sat.	
	Sept.												
S-1	29	3 P..	135	....	....	......	0	......	......	13.9	0	0	......
S-2	29	3 P..	600,000	.01	....	......	500	350	14	15.6	0	0	......
S-3	29	3 P..	8,000	.1	....	......	250	154	92	15	0	0	......
S-4	30	10.30 A..	5,300	....	....	......	5	24	125	10.6	0	0	.. ...
S-5	30	11 A..	1,000	....	....	......	15	......	30	12.8	8.6	81	......
S-6	30	9.30 A..	3,800	.1	....	......	10	208	4	11.7	8.2	76	......
S-7	30	10 A..	1,900	1.0	....	......	40	120	3	11.7	8.6	80	......
S-8	30	1 P..	1,000	....	....	......	......	224	3	15.2	5.2	51	......

Sources of Samples.

S-1 Sulphur Creek above confluence with sewage.
S-2 Sebring crude sewage.
S-3 Sulphur Creek, 150 ft. below confluence with sewage.
S-4 Sulphur Creek, 1 mile below confluence with sewage.
S-5 Sulphur Creek, 2.5 miles below confluence with sewage.
S-6 Sebring water supply (Mahoning River), tap at pumping station.
S-7 Creek receiving cellar drainage of Sebring.
S-8 Sebring water supply, from tap at livery stable.

RESULTS OF FIELD ANALYSES—DURING SECOND EXAMINATION.

(Continued.)

Mahoning River above Alliance, below Fish Creek.

No. of Samp.	Date. 1908.	Time.	Bacteria Per C. C.	Coli.		Color.	Turbidity.	Alkalinity.	Free	Temp.	Dissolved Oxygen.		Odor
				Present In C. C.	Absent In C. C.				CO$_2$	Deg. C.	Pts. Per Mil.	% Sat.	
A-20	Sept. 29	9 A..	2,000	....	....	15	45	200	3	14	6.6	64	1 E
A-21	29	2.30 P..	2,500	....	....	15	45	204	4	15	8.0	79	1 E

Sewage at Alliance outfall.

No. of Samp.	Date. 1908.	Time.	Bacteria Per C. C.	Coli. Present In C. C.	Coli. Absent In C. C.	Color.	Turbidity.	Alkalinity.	Free CO$_2$	Temp. Deg. C.	Dissolved Oxygen Pts. Per Mil.	Dissolved Oxygen % Sat.	Odor
A-29	29	9.30 A..	1,200,000	....	....	......	40	244	8	16.7	1.6	16	3 S
A-30	29	3.30 P..	820,000	.002	....	......	100	270	6	17.8	1.0	10	3 S
A-31	20	9.15 P..	680,000	....	....	......	90	250	5	16.7	1.2	12	3 S
A-32	30	7.40 A..	700,000	....	....	......	40	272	7	16.1	1.8	18	3 S

Mahoning River, 500 ft. below outfall.

No. of Samp.	Date. 1908.	Time.	Bacteria Per C. C.	Coli. Present In C. C.	Coli. Absent In C. C.	Color.	Turbidity.	Alkalinity.	Free CO$_2$	Temp. Deg. C.	Dissolved Oxygen Pts. Per Mil.	Dissolved Oxygen % Sat.	Odor
A-33	29	9.35 A..	6,000,000	....	....	15	40	230	6	17.8	1.0	10	3 S
A-34	29	3.30 P..	720,000	....	....	......	120	262	6	17.8	0.6	6	3 S
A-35	29	9.15 P..	600,000	....	....	......	60	250	6	16.7	0.4	4	3 S
A-36	30	7.50 A..	420,000	....	....	......	40	232	7	14.4	1.3	12	3 S
A-22	29	10.30 A..	900	3.0	....	15	20	192	4	14	6.6	64	0
B-1	Oct. 1	8 A..	40,000	.1	....	20	100	240	9	12	0	0	4 S
B-2	1	8.30 A..	6,500	.1	....	20	90	238	8	13	0	0	2 S
B-3	1	10 A..	1,000	.1	....	20	45	176	3	13	1.0	9	1 V
P-1	1	1 P..	475	1.0	....	20	25	152	4	....	9.6	......	1 V
K-1	1	1.30 P..	475	1.0	....	15	15	198	3	....	10.0	......	1 V
N-1	1	11.30 A..	825	.5	....	20	15	150	4	....	9.8	......	1 V
N-2	1	11.30 A..	550	.5	....	5	15	188	4	....	9.6	......	1 V
N-3	1	11.30 A..	1,200	.5	....	10	15	176	4	....	10.0	......	1 V

Sources of Samples.

A-22	Alliance Water supply, tap at Keplinger Hotel.
B-1	Mahoning River, 2 miles below Alliance.
B-2	Mahoning River, 4 miles below Alliance.
B-3	Mahoning River, 11 miles below Alliance.
P-1	Mahoning River, at Pricetown, 100 ft. north of Holland dam.
N-1	Mahoning River, at Newton Falls, East Branch.
N-2	Mahoning River, at Newton Falls, West Branch.
N-3	Mahoning River, at Newton Falls below confluence.
K-1	Kale Creek, near Mahoning River.

Mahoning River at intake of Warren water works.

No. of Samp.	Date. 1908.	Time.	Bacteria Per C. C.	Coli.		Color.	Turbidity.	Alkalinity.	Free	Temp.	Dissolved Oxygen.		Odor
				Present In C. C.	Absent In C. C.				CO$_2$	Deg. C.	Pts. Per Mil.	% Sat.	
W-1	Oct. 2	9.45 A..	4,000	.3	....	15	20	140	1	13	8.0	76	1 E
W-4	2	2.30 P..	3,100	3.0	1.0	15	20	147	0	13	9.4	89	1 E
W-6	2	8.30 P..	2,700	3.0	1.0	15	20	150	0	13	8.7	87	1 E
W-8	3	7.30 A..	1,600	3.0	1.0	15	20	143	0	13	9.6	91	1 E

Filtered water, tap in laboratory Warren water works.

No. of Samp.	Date. 1908.	Time.	Bacteria Per C. C.	Coli. Present In C. C.	Coli. Absent In C. C.	Color.	Turbidity.	Alkalinity.	Free CO$_2$	Temp. Deg. C.	Dissolved Oxygen Pts. Per Mil.	Dissolved Oxygen % Sat.	Odor
W-2	2	10 A..	450	50.0	3.0	5	0	129	7	13.5	9.3	89	0
W-5	2	2.30 P..	250	50.0	3.0	5	0	133	7	15	9.4	93	0
W-9	3	7.45 A..	600	....	50.0	5	0	138	4	14	8.7	84	0

RESULTS OF FIELD ANALYSES—DURING SECOND EXAMINATION.
(Continued.)

Warren water supply, tap at Park Hotel.

No. of Samp.	Date. 1908.	Time.	Bacteria Per C. C.	Coli.		Color.	Turbidity.	Alkalinity.	Free	Temp.	Dissolved Oxygen.		Odor
				Present In C. C.	Absent In C. C.				CO$_2$	Deg. C.	Pts. Per Mil.	% Sat.	
W-3	2	2 P..	400	50.0	3.0	5	0	132	7	18	8.4	88	0
W-7	3	7 A..	230	....	50.0	5	0	138	5	17	8.2	84	0

Mahoning River, 600 ft. below Warren sewers.

No. of Samp.	Date. 1908.	Time.	Bacteria Per C. C.	Coli. Present In C. C.	Coli. Absent In C. C.	Color.	Turbidity.	Alkalinity.	Free CO$_2$	Temp. Deg. C.	Dissolved Oxygen. Pts. Per Mil.	Dissolved Oxygen. % Sat.	Odor
W-11	2	9.30 A..	300,000	.001	....	......	15	152	3	....	8.2	......	2 S
W-12	2	2.30 P..	350,000	.005	.001	......	15	152	3	....	8.4	......	2 S
W-13	2	8.30 P..	300,000	.005	....	......	15	134	7	....	7.0	......	2 S
W-14	3	8 A..	230,000	.2	.005	......	10	146	6	....	7.8	......	2 S
W-67	2	9 A..	2,000	.5	....	......	30	176	6	12.8	7.6	72	2 E
W-64	2	2 P..	375,000	.05	....	......	......	90	70	10.7	4.7	42	1 E
W-65	2	2.30 P..	6,000	1.0	.5	......	......	382	75	....	5.0	......	1 A

Sources of Samples.

W-67 Mahoning River, below Eagle Creek.
W-64 Effluent from sewage purification plant, Trumbull Co. infirmary.
W-65 Young's Run, near Mahoning Avenue.

Mahoning River above Niles, near water works station.

No. of Samp.	Date. 1908.	Time.	Bacteria Per C. C.	Coli.		Color.	Turbidity.	Alkalinity.	Free	Temp.	Dissolved Oxygen		Odor
				Present In C. C.	Absent In C. C.				CO$_2$	Deg. C.	Pts. Per Mil.	% Sat.	
	Oct.												
N-71	5	3.30 P..	200,000	.001	....	15	18	162	2	16	9.0	90	......
N-72	5	9.30 P..	71,000	....	.025	15	18	164	2	14	9.4	91	......
N-73	6	7.30 A..	34,000	.025	.005	15	18	156	3	13	8.6	81	......
N-74	6	2 P..	110,000	.005	.001	15	18	150	4	16	10	100	......

Mahoning River below Niles, at Erie R. R. bridge.

No. of Samp.	Date. 1908.	Time.	Bacteria Per C. C.	Coli. Present In C. C.	Coli. Absent In C. C.	Color.	Turbidity.	Alkalinity.	Free CO$_2$	Temp. Deg. C.	Dissolved Oxygen Pts. Per Mil.	Dissolved Oxygen % Sat.	Odor
N-76	5	4 P..	160,000	....	.025	15	18	152	5	14.4	8.2	79	2 E
N-77	5	9.50 P..	130,000	....	.025	12	18	150	4	13.3	7.2	69	2 E
N-78	6	7.30 A..	160,000	.025	.005	12	20	150	4	8.9	8.0	69	2 E
N-79	6	2 P..	390,000	.025	.005	12	20	164	4	15.6	9.7	97	2 E

Mahoning River below Girard.

No. of Samp.	Date. 1908.	Time.	Bacteria Per C. C.	Coli. Present In C. C.	Coli. Absent In C. C.	Color.	Turbidity.	Alkalinity.	Free CO$_2$	Temp. Deg. C.	Dissolved Oxygen Pts. Per Mil.	Dissolved Oxygen % Sat.	Odor
N-81	5	5 P..	22,000	....	.025	12	15	130	3	16	8.4	84	......
N-82	6	9 A..	33,000	.025	.005	12	15	114	3	14	7.0	68	......
N-85	6	10 A..	3,100	1.0	0.3	15	10	100	3	5.6	8.2	66	......
N-86	6	11 A..	7,400	.1	....	25	26	80	10	14	8.4	81	......
N-87	6	11 A..	8,500	.05	....	3	5	180	4	18.9	11.0	118	......

Sources of Samples.

N-85 Meander Creek.
N-86 Mosquito Creek.
N-87 Niles water supply from tap at Allison Hotel.

RESULTS OF FIELD ANALYSES—DURING SECOND EXAMINATION.

(Concluded.)

No. of Samp.	Date. 1908.	Time.	Bacteria Per C. C.	Coli.		Color.	Turbidity.	Alkalinity.	Free	Temp.	Dissolved Oxygen.		Odor
				Present In C. C.	Absent In C. C.				CO_2	Deg. C.	Pts. Per Mil.	% Sat.	
Mahoning River above Youngstown at Briar Hill.													
Y-90	Oct. 7	2.30 P..	15,000	1.0	.1	15	5	126	4	15.6	9.0	90	1 E
Y-91	7	9 P..	3,300	.1	.01	15	5	124	4	13.3	9.0	86	1 E
Y-92	8	8.30 A..	8,300	.1	.01	15	5	120	5	14.4	8.4	82	1 E
Y-93	8	2.30 P..	6,400	.1	.01	15	5	84	4	15.6	9.0	90	1 E
Mahoning River at Youngstown water works.													
Y-95	7	2.30 P..	90,000	.1	.01	20	20	126	2	26	5.4	66	......
Y-96	7	9 P..	55,000	.1	.03	......	20	126	4	24	7.0	82	......
Y-97	8	7.30 A..	19,000	.1	.03	15	16	126	5	25	5.3	63	......
Y-98	8	2.30 P..	15,000	.03	.01	10	15	124	0	25	5.2	62	......
Filtered water at Youngstown purification plant.													
Y-100	7	2.30 P..	550	3.	1.	0	0	99	23	24	3.7	43	......
Y-101	7	9 P..	190	25.	3.	0	0	96	19	25	3.5	42	......
Y-102	8	8 A..	150	25.	3.	4	0	94	25	24	3.6	42	......
Y-103	8	2.30 P..	130	50.	3.	4	0	99	18	24	3.5	41	......
Mahoning River below Youngstown, 900 ft. below Haselton bridge.													
Y-105	7	3 P..	1,100,000	.0005	....	18	100	168	15	31.1	0	0	3 S
Y-106	7	9 P..	1,800,000	.0005	....	18	100	168	10	30.6	0	0	3 S
Y-107	8	8 A..	820,000	.0005	....	18	100	174	10	28.9	0	0	4 S
Y-108	8	2 P..	1,700,000	.0005	....	18	75	190	10	29.4	0	0	4 S
Mahoning River above Struthers, 600 ft. above dam.													
S-120	8	11 A..	17,000	....	.1	20	40	82	20	32.8	4.6	64	2 A
S-121	8	4 P..	42,000	.1	.01	20	40	80	18	33.3	3.4	47	2 A
S-122	9	10 A..	370,000	.01	.001	20	40	64	20	34.4	3.8	54	2 O
Mahoning River below Struthers, 1200 ft. below dam.													
S-125	8	11 A..	30,000	.1	.01	18	40	78	20	30.0	3.6	45	2 A
S-126	8	4 P..	10,000	.1	.01	18	40	76	20	30.0	3.4	45	2 A
S-127	9	10 A..	2,700	....	.1	18	50	52	20	25.6	4.4	53	2 A
Mahoning River, 300 ft. below Lowellville dam.													
L-130	8	10 A..	17,000	.01	....	15	5	82	4	17.8	7.2	75	2 E
L-131	8	3 P..	5,000	.01	....	15	5	84	6	17.8	5.4	56	2 E
L-132	9	8.30 A..	2,800	.1	.01	15	5	84	6	17.8	7.8	81	1 E
Y-109	7	3.30 P..	300,000	.0005	....	15	300	180	18	24.4	0	0	5 S
Y-300	8	3 P..	5,700	.1	.01	15	30	118	2	28.9	5.2	67	1 E
S-150	9	10 A..	75	3.	1	10	5-	64	4	13.9	3.6	35	1 E
S-151	9	10.30 A..	1,300	.01	.001	18	60	62	6	46.7	3.8	67	2 A
B	9	12 M..	1,000,000	.0005	....	18	200	118	6	39	4.8	74	2 A
C	9	12.30 P..	140,000	.0005	....	18	200	110	6	44	4.0	67	2 A
D	9	12.45 P..	500±	....	.01	18	300	82	6	40	3.1	49	3 A

Sources of Samples.

Y-109 Crab Creek near Mahoning River.
Y-300 Main drain from upper plant, Ohio Steel Works, 1 mile above Youngstown water works intake.
S-150 Struthers water supply, tap at office of Struthers Furnace Co.
S-151 Main drain, Struthers Furnace Co.

Samples from Youngstown Sheet and Tube Co.

B Wastes from tube mills, receiving practically all the sanitary drainage of the tube mills.
C Wastes from steel plant, receiving sanitary drainage.
D Wastes from puddle mill, receiving sanitary drainage; also a considerable quantity of acid pickling liquors.

RESULTS OF FIELD DETERMINATIONS—THIRD EXAMINATION.

No. of Samp.	Date. 1909.	Time.	Bacteria Per C. C.	Coli.		Color.	Turbidity.	Alkalinity.	Free	Temp.	Dissolved Oxygen.		Odor
				Present In C. C.	Absent In C. C.				CO_2	Deg. C.	Pts. Per Mil.	% Sat.	
A-1	Feb. 9	8.35 A..	2,100	....	3.0	......	24	62	4	1.0	12.8	87	......
A-13	10	3 P..	1,600	1.0	0.3	......	60	59	2	4.5	10.0	77	......
A-10	9	11.30 A..	1,500	0.3	0.1	......	20	55	3	7.0	12.8	105	......
A-5	9	9.15 A..	2,000	0.3	0.1	......	20	62	4	0.3	13.2	92	......
A-11	9	1.15 P..	110	50.	3.	......	5-	200	6	9.5	11.0	97	......
A-12	9	2.20 P..	43,000	.01	.001	......	300	55	3	4.5	6.4	49	3 Oil

Sources of Samples.

A-1	River above Alliance, 1,000 ft. below Fish Creek.
A-13	River at dam, Alliance water works intake.
A-5	Creek at Patterson Road.
A-11	Well in public square at Alliance.
A-12	Trail's Run, near Mahoning River.
A-10	Alliance water supply, from tap at Keplinger Hotel.

Sewage at Alliance outfall.

No. of Samp.	Date. 1909.	Time.	Bacteria Per C. C.	Coli.		Color.	Turbidity.	Alkalinity.	Free	Temp.	Dissolved Oxygen.		Odor
				Present In C. C.	Absent In C. C.				CO_2	Deg. C.	Pts. Per Mil.	% Sat.	
20-A	Feb. 9	9 A..	80,000	.001	....	......	60	148	—64	7.0	8.0	66	3 Sew
22-A	9	2.30 P..	125,000	.01	.001	......	65	140	—60	7.0	6.8	56	3 Sew
24-A	9	9 P..	95,000	.001	....	......	65	......	......	8.0	7.2	81	3 Sew
Mahoning River, 500 ft. below outfall.													
21-A	9	9.10 A..	12,000	.01	.001	......	45	74	—16	1.0	12.8	87	1 Sew
23-A	9	2.40 P..	63,000	.01	.001	......	50	70	—20	1.0	11.0	75	1 Sew
25-A	9	9 P..	12,500	.001	....	......	80	66	2	1.0	11.2	76	1 Sew
27-A	10	10.30 A..	26,000	.1	....	......	250	41	1	0.5	13.2	92	1 Sew
....	......	....	....	....	....	......	......	......	......	....	......	......	......
A-33	9	11 A..	37,000	.1	.05	......	35	60	2.5	2.0	12.1	87	1 Sew
A-32	9	10.15 A..	4,200	.1	....	......	30	54	2	2.0	12.1	87	......
A-31	9	9.45 A..	1,300	.1	....	......	30	54	2	2.0	12.7	92	......
A-30	9	9.15 A..	1,600	.3	.1	......	30	48	2	2.0	12.8	92	......
N-35	10	10.30 A..	7,100	.3	.1	......	150	37	2	1.0	13.4	91	......
N-36	10	11 A..	6,000	.3	.1	......	60	27	2	1.0	13.3	90	......

Sources of Samples.

A-33	Mahoning River, 3 miles below Alliance.
A-32	Mahoning River 4.5 miles below Alliance.
A-31	Mahoning River, 6 miles below Alliance.
A-30	Mahoning River, 8 miles below Alliance, at Deerfield.
N-35	West Branch of Mahoning River at Newton Falls.
N-36	East Branch of Mahoning River at Newton Falls.

RESULTS OF FIELD DETERMINATIONS—THIRD EXAMINATION.
(Continued.)

Mahoning River at intake of water works.

No. of Samp.	Date. 1909.	Time.	Bacteria Per C. C.	Coli.		Color.	Turbidity.	Alkalinity.	Free	Temp.	Dissolved Oxygen		Odor
				Present, In C. C.	Absent In C. C.				CO$_2$	Deg. C.	Pts. Per Mil.	% Sat.	
W-40	Feb. 11	9 A..	8,300	.1	....	......	120	19	11	0	13.6	93	......
W-44	11	2.30 P..	8,000	.3	.1	50	130	19	2	0	13.8	94	......
W-47	11	9 P..	9,100	.3	.1	......	......	19	2	0	13.8	94	......
W-50	12	9 A..	17,500	.1	....	......	110	26	2	0	13.9	95	......
Settled water, top of filters.													
W-41	11	9.30 A..	2,400	....	....	......	40	13	10	1	13.9	95	......
W-45	11	2.30 P..	2,700	....	....	......	45	11	6	1	13.9	95	......
Filtered water, tap in laboratory Warren water works.													
W-42	11	10 A..	125	....	50	5	0	14	10	2	13.9	97	......
W-46	11	2.45 P..	125	....	50	5	0	12	7	3	13.8	102	......
W-48	11	9 P..	320	....	50	......	0	11	......	2	14.2	99	......
W-51	12	9 A..	175	50	3	6	0	13	7	1.5	14.2	101	......
Warren water supply, tap at Park Hotel.													
W-43	11	2 P..	90	50	3	7	0	12	15	4.5	13.9	107	......
W-49	12	8 A..	500	....	50	6	0	16	6	4.0	13.8	105	......
Mahoning River, 600 ft. below Warren sewers.													
W-30	11	9 A..	16,000	....	....	......	110	40	2	0	14.0	95	1 E
W-31	11	2.30 P..	17,000	.05	....	......	120	33	1	0	......	......	1 E
W-32	11	9 P..	11,000	.05	....	......	110	39	2	0	10.2	69	1 E
W-33	12	9 A..	8,000	.05	....	......	100	33	2	0	13.6	93	1 E
Mahoning River, above Niles near water works station.													
N-52	12	9 A..	8,000	.05	....	......	100	30	1	1.0	14.0	95	......
N-60	15	10.30 A..	60,000	....	....	......	150	24	4	3.0	13.2	98	2 A
N-61	15	4 P..	47,000	....	....	......	220	19	3	2.0	13.6	95	2 A
N-62	15	11 P..	180,000	.1	.01	......	350	15	4	2.0	12.8	90	2 A
N-63	16	10 A..	50,000	.1	.01	......	230	13	3	1.5	13.6	97	2 A
Mahoning River, below Niles at Erie R. R. bridge.													
N-65	15	10.30 A..	70,000	....	....	......	110	24	4	0.5	12.8	88	2 A
N-66	15	4 P..	47,000	....	....	......	200±	16	4	0	13.3	91	2 A
N-67	15	10 P..	68,000	.1	.01	......	350	10	7	1.0	12.8	87	2 A
N-68	16	10 A..	44,000	.01	....	......	250	14	2	0	13.4	91	2 A
Mahoning River below Girard, 100 ft. below dam.													
G-70	15	4 P..	43,000	....	....	......	170	23	15	2.5	13.3	97	......
G-71	15	11 P..	68,000	.1	.01	......	250	11	3	1.5	......	......	......
G-72	16	10 A..	48,000	.5	.1	......	220	15	2	1.0	13.6	93	......
N-50	11	10 A..	11,000	.1	....	......	180	22	1	0.5	12.4	86	1 E
N-51	11	10 A..	21,000	.5	.1	......	45	30	1	0.5	13.2	91	1 E
L-55	12	2.30 P..	4,300	.05	....	......	110	28	......	3.5	13.9	105	......
N-53	12	9 A..	150	.5	....	......	15	182	4	9.5	12.4	108	......
N-75	15	3.30 P..	25	....	....	......	10±	183	6	10.0	10.4	92	......
N-76	15	3.40 P..	9	....	....	......	0	201	7	12	12.0	111	......
N-78	15	9.50 P..	69,000	.1	.01	......	230	60	3	5	12.8	99	......
N-77	15	3.30 P..	68	....	....	......	5	178	7	8	10.8	91	......
N-79	15	10.25 P..	39,000	.1	.01	......	160	69	3	....	11.6	......	......

Sources of Samples.

N-50	Mosquito Creek, 1 mile above Mahoning.
N-51	Meander Creek, near Mahoning River.
L-55	Mahoning River, below dam at Lowellville.
N-53	Niles water supply, tap at Allison Hotel.
N-75	Niles Water supply, tap in force main near pump.
N-76	Niles water supply, wells Nos. 2, 3, 4.
N-77	Niles water supply, tap at McGurk Hotel.
N-78	Niles water supply tap in force main near pump.
N-79	Niles water supply, tap at Allison Hotel.

NOTE.—Began to pump river water on February 15, at about 6 P. M., and stopped at 10:57 P. M.

RESULTS OF FIELD DETERMINATIONS—THIRD EXAMINATION.

(Concluded.)

Mahoning River, above Youngstown at Briar Hill.

No. of Samp.	Date. 1909.	Time.	Bacteria Per C. C.	Coli.		Color.	Turbidity.	Alkalinity.	Free	Temp.	Dissolved Oxygen.		Odor
				Present In C. C.	Absent In C. C.				CO_2	Deg. C.	Pts. Per Mil.	% Sat.	
Y-80	Feb. 17	10.30 A..	16,000	.5	.1	......	100	14	4	0	14.0	95	1 E
Y-81	17	4.30 P..	14,000	.5	.1	......	80	14	3	0	14.8	101	1 E
Y-82	17	10 P..	13,000	.1	.01	......	60	10	2	0	15.2	103	1 E
Y-83	18	8 A..	13,000	.5	.1	......	85	16	4	0	14.0	95	1 E
Mahoning River at Youngstown water works.													
Y-85	17	10 A..	280,000	.01	....	60	130	19	3	3.0	13.0	96	2 E
Y-88	17	3 P..	15,000	3.	1.	......	90	18	2	3.0	13.2	98	2 E
Y-91	17	10 P..	14,000	3.	1.	60	75	18	4	3.0	12.6	93	2 E
Y-93	18	9 A..	21,000	.05	.01	60	65	17	2	3.0	12.9	96	2 E
Filtered water at Youngstown purification plant.													
Y-86	17	10 A..	140	....	50	5	0	4	17	3.0	13.6	101	1 E
Y-89	17	3.30 P..	220	....	50	5	0	3	10	3.5	14.0	105	1 E
Y-92	17	10 P..	150	....	25	5	0	4	8	1.5	13.5	96	1 E
Y-94	18	9 A..	180	....	25	5	0	6	8	2.5	13.6	100	1 E
Youngstown water supply, tap at Colonial Hotel.													
Y-87	17	1.30 P..	220	....	50	8	0	3	12	4.0	14.0	106	1 E
Y-90	17	9.15 P..	85	....	50	8	0	4	7	3.0	13.0	96	1 E
Mahoning River below Youngstown, 900 ft. below Haselton bridge.													
Y-100	17	10 A..	9,000	.1	.01	......	105	20	4	1.0	13.5	95	1 E
Y-101	17	4.30 P..	35,000	.1	.01	......	90	18	2	2.0	14.8	107	1 E
Y-102	17	10 P..	23,000	.1	.01	......	95	17	2	2.0	10.8	78	1 E
Y-103	18	9 A..	10,000	.01	.001	......	85	18	4	2.0	13.6	98	1 E
Mahoning River above Struthers, 600 ft. above dam.													
S-105	18	8 A..	12,000	.1	.01	......	85	18	5	2.0	12.8	92	1 E
S-106	18	2.30 P..	11,000	.1	.01	......	85	22	2	3.0	12.4	92	1 E
S-107	18	9.30 P..	7,500	.01	.001	......	......	18	2	3.0	14.8	107	1 E
S-108	19	9 A..	4,500	.1	.01	......	60	20	4	3.0	12.4	92	1 E
Mahoning River below Struthers, 1200 ft. below dam.													
S-110	18	7.30 A..	30,000	....	.1	......	85	18	4	2.0	13.2	96	1 E
S-111	18	3 P..	18,000	.01	.001	......	85	21	2	3.0	16.0	115	1 E
S-112	18	9.30 P..	13,000	.01	.001	......	......	20	3	3.0	13.2	98	1 E
S-113	19	9 A..	3,800	.1	.01	......	60	20	2	3.0	12.4	92	1 E
Mahoning River, 400 ft. below Lowellville dam.													
N-55	12	2.30 P..	4,300	.05	....	......	110	28	......	3.5	13.9	105	1 E
L-115	18	10 A..	23,000	....	.01	......	85	18	4	1.0	13.2	92	1 E
L-116	18	3 P..	15,000	.1	.01	......	85	19	2	1.0	12.8	89	1 E
L-117	18	10 P..	8,000	.01	.001	......	......	20	2	1.0	12.0	84	1 E
L-118	19	10 A..	4,000	.1	.01	......	60	20	2	1.0	12.4	87	1 E

RESULTS OF LABORATORY ANALYSES — FIRST EXAMINATION.

No. of Samp.	Date. 1908.	Sources of Samples.	N. as Free NH$_3$.	Oxyg. Cons.	Chlorine.	Iron (Fe).
	July					
S-1	14	Sulphur Creek, above Sebring sewage	.40	9.8	21.1	80
S-2	14	Sebring crude sewage	6.4	36.	46.1	......
S-3	14	Sulphur Creek, 150 ft. below sewage	2.8	25.	30.4	80
S-4	14	Sulphur Creek, 1 mile below sewage	3.4	8.0	30.8	20
S-5	14	Sulphur Creek, 2.5 miles below sewage	3.4	8.0	30.8	10
S-6	15	Sebring water supply, tap at pumping station	.16	4.4	6.5	......
S-7	15	Creek receiving cellar drainage of Sebring	.08	5.1	4.3	......
S-8	15	Sebring water supply, from tap at office of H. R Ewing	.08	3.6	4.3	......
A-24	15	Mahoning River, above Fish Creek	....	5.1	5.6	1.2
Comp.	14–15	Mahoning River, above Alliance	.16	6.5	4.7	1.6
Comp.	14–15	Sewage at Alliance outfall	7.2	18.	35.	......
A-37	15	Tap near pump, Alliance water works	.24	7.3	5.6	......
Comp.	14–15	Mahoning River, 500 ft. below outfall	2.0	9.6	17.0	......
1	17	Mahoning River, 3.5 miles below Alliance	1.2	6.1	14.0	......
2	17	Mahoning River, 6 miles below Alliance	.40	7.0	8.0	......
3	17	Mahoning River, 8 miles below Alliance	.08	7.2	8.0	......
Comp.	17	East Fork of Mahoning River, at Newton Falls	.08—	5.3	8.0	......
Comp.	17	West Fork of Mahoning River, at Newton Falls	.24	7.1	1.7	......
Comp.	17	Mahoning River, below Newton Falls	.08	5.5	6.5	......
W-66	20	Eagle Creek, near Mahoning River	.24	12.0	0.5	......
W-67	20	Mahoning River, below Eagle Creek	.24	9.8	2.8	......
W-64	22	Effluent from sewage purification plant, Trumbull Co. Infirmary	1.1	7.0	37.0	......
W-65	22	Young's Run, near Mahoning Ave	.24	11.0	1.7	......
Comp.	21–22	Mahoning River, at intake of Warren water works	....	......	......	......
		Filtered water at Warren water works	....	......	......	......
		Mahoning River, 600 ft. below Warren sewers	.40	9.4	12.0	......
Comp.	23–24	Mahoning River, near Niles water works station	.24	6.6	5.0	......
Comp. N-74	23–24 24	Mahoning River, below Niles near Erie R. R. bridge	.24	7.4	7.5	......
N-84	24	Niles water supply, tap at Allison Hotel	.08	0.9	27.0	0.8
		Mosquito Creek, 1 mile above Mahoning River	.16	13.0	2.2	......
N-83	24	Meander Creek, near Mahoning River	.24	9.1	3.3	......
Comp.	23–24	Mahoning River, below Girard	.16	7.3	8.0	......
Comp.	27–28	Mahoning River, above Youngstown at Brier Hill	.08—	9.4	10.5	1.6
Comp.	27–28	Mahoning River, at Youngstown water works	.16	16.3	8.5	1.5
Comp.	27–28	Mahoning River, below Youngstown at Haselton	.16	6.9	11.5	3.2
Y-99	29	Mill Creek, near Mahoning River	.08—	5.7	4.5	0.5
Y-109	28	Crab Creek, near Mahoning River	1.2	14.0	29.0	2.5
Y-110	29	Wastes, upper plant, Ohio Steel Co	.08—	10.0	13.0	2.6
Y-111	29	Wastes, lower plant, Ohio Steel Co	.16	4.9	11.0	1.7
Comp.	28–29	Mahoning River, above Struthers	.40	6.7	13.0	5.0
Comp.	28–29	Mahoning River, below Struthers	.48	2.8	14.0	3.2
Comp.	28–29	Mahoning River, 300 ft. below Lowellville dam	.64	5.7	14.0	1.4
S-140	29	Struthers water supply	.08—	6.5	0.5	0.2
S-141	29	Drain from Struthers Furnace Co	.48	7.1	13.5	2.2
S-142	29	Yellow Creek, at mouth	.08	6.4	5.5	15.0
Y-143	29	Drain from sheet mill of Youngstown Sheet & Tube Co.	.48	6.6	14.5	2.5

Sulphates (SO_4): Sample No. S-1, 60; Sample No. N-74, 9.0.
Incrustants: Sample No. N-74, 135.

RESULTS OF LABORATORY ANALYSES—SECOND EXAMINATION

No. of Samp.	Date. 1908.	Sources of Samples.	N. as Free NH_3.	Oxyg. Cons.	Chlorine.	Iron (Fe).
	July					
S–1	29	Sulphur Creek, above Sebring sewage	.8	2.9	23.0	50
S–2	29	Sebring crude sewage	16.0	......	94.0	......
S–3	29	Sulphur Creek, 150 ft. below sewage	13.0	......	59.0	40
S–4	29	Sulphur Creek, 1 mile below sewage	3.0	2.4	38.0	2.0
S–5	29	Sulphur Creek, 2.5 miles below sewage	7.0	2.1	42.0	45
S–6	29	Sebring water supply, tap at pumping station	0.1	3.4	6.5	......
S–7	29	Creek receiving cellar drainage of Sebring	0.1	4.8	6.5	......
S–8	29	Sebring water supply, tap at livery stable	0.1	2.4	5.5	......
Comp.	7/29	Mahoning River, above Alliance	.15	6.4	5.5	......
A–22	7/29	Alliance water supply, tap at Keplinger's Hotel	.2	5.8	8.0	1.0
Comp.	7/29–30	Sewage at Alliance outfall	9.6	5.0	33.0	......
Comp.	7/29–30	Mahoning River, 500 ft. below Alliance outfall	8.0	3.7	36.0	......
	Oct.					
B–1	1	Mahoning River, 2 miles below Alliance	.15	......	41.0	......
B–2	1	Mahoning River, 4 miles below Alliance	.12	......	24.0	......
B–3	1	Mahoning River, 11 miles below Alliance	0.0	......	24.0	......
P–1	1	Mahoning River, at Pricetown	0.0	......	22.0	......
K–1	1	Kale Creek, near Mahoning River	0.0	......	16.0	......
N–1	1	East fork of Mahoning River, at Newton Falls	0.0	......	......	......
W-67	2	Mahoning River, below Eagle Creek	0.2	6.1	9.5	......
W-64	2	Effluent from sewage purification plant, Trumbull Co. Infirmary	1.6	3.4	4.5	......
W–65	2	Young's Run, at Mahoning Ave	.12	6.1	63.0	......
Comp.	2–3	Mahoning River, at intake of Warren water works	.48	6.2	13.0	......
Comp.	2–3	Filtered water at Warren water works	0.12	2.9	8.5	0.4
Comp.	2–3	Warren water supply, tap at Park Potel	0.06	2.8	8.0	0.5
Comp.	2–3	Mahoning River, 600 ft. below Warren sewers	.2	3.8	7.5	......
Comp.	5–6	Mahoning River, near Niles water works station	.04	5.3	28.0	......
Comp.	5–6	Mahoning River, below Niles near Erie R. R. bridge	.08	5.8	33.5	......
N–87	6	Niles water supply, tap at Allison Hotel	.04	1.7	27.0	0.9
N–86	6	Mosquito Creek, 1 mile above Mahoning River	.04	2.5	7.0	......
N–85	6	Meander Creek, near Mahoning River	.04	3.4	14.5	......
Comp.	5–6	Mahoning River, below Girard	.34	3.6	53.8	......
Comp.	7–8	Mahoning River, above Youngstown at Briar Hill	3.6	2.6	44.0	0.7
Comp.	7–8	Mahoning River, at Youngstown water works	12.0	2.9	44.5	0.9
Comp.	7–8	Mahoning River, below Youngstown at Haselton	28.0	7.7	52.0	3.0
Comp.	7–8	Youngstown water supply at filter plant	4.0	2.0	48.0	0.6
Y–109	7	Crab Creek, near Mahoning River	57.0	28.8	75.0	......
Y–116	8	Wastes, upper plant Ohio Steel Co	4.8	2.9	49.0	1.1
Y–117	8	Wastes, lower plant Ohio Steel Co	8.0	3.0	44.5	6.0
Y–300	8	Drain from furnaces, Ohio Steel Co	6.4	2.6	48.5	......
Y–115	8	Youngstown water supply, at Colonial Hotel	3.2	2.1	44.5	0.8
Comp.	8–9	Mahoning River, above Struthers	14.0	3.9	46.0	6.0
Comp.	8–9	Mahoning River, below Struthers	16.0	3.9	46.0	6.0
Comp.	8–9	Mahoning River, below Lowellville	14.0	3.4	50.5	0.6
S-150	9	Struthers water supply, tap at office of Struthers Furnace Co.	1.2	5.6	1.5	0.9
S–151	9	Drain from Struthers Furnace Co	26.0	4.6	45.5	......
S-152	9	Acid iron wastes, Youngstown S. & T. Co	28.0	70.0	......	......
1	9	Tube mill wastes, Youngstown S. & T. Co	28.0	6.7	56.0	......
2	9	Steel plant wastes, Youngstown S. & T. Co	20.0	5.2	57.0	......
3	9	Puddle mill wastes, Youngstown S. & T. Co	24.0	5.4	55.5	......

Sulphates (SO_4): Sample No. S-1, 1040; sample No. S-3, 808.

Incrustants: Sample No. S–1, 495; sample No. A–22, 123; sample No. N-87, 95; comp. above Youngstown, 95; comp. at Youngstown filter plant, 100; comp. below Youngstown, 95; comp. filtered water at Youngstown plant, 120; comp. above Struthers, 185; composite below Lowellville, 180; sample No. S–150, 30; sample No. S–151, 185.

RESULTS OF LABORATORY ANALYSES—THIRD EXAMINATION.

No. of Samp.	Date. 1909.	Sources of Samples.	N. as Free NH_3.	Oxyg. Cons.	Chlorine.	Iron (Fe).	Sulphates (SO_4).
	Feb.						
A-1	9	Mahoning River, above Alliance	.12	3.5	3.0	......	......
A-5	9	Creek, East Alliance, at Patterson Road	.10	1.9	16.0	......	......
A-12	9	Trail's Run	1.04	7.3	17.0	......	......
A-10	9	Alliance water supply, tap at Keplinger Hotel	.09	4.2	6.0	......	......
A-11	9	Well in public square at Alliance	0	0.4	46.0	......	......
A-13	10	Mahoning River at dam, Alliance water works	.10	3.5	......	0.5	......
Comp.	9	Sewage at Alliance outfall	1.0	23.6	19.0	......	......
Comp.	9-10	Mahoning River, 500 ft. below Alliance outfall	......	5.8	13.0	......	......
A-33	9	Mahoning River, 3 miles below Alliance	1.2	4.0	5.0	......	......
A-32	9	Mahoning River, 4.5 miles below Alliance	1.0	4.6	7.0	......	......
A-31	9	Mahoning River, 6 miles below Alliance	0.8	4.4	5.0	......	......
A-30	9	Mahoning River, 8 miles below Alliance	0.6	4.8	6.0	......	......
N-35	10	West branch Mahoning River, at Newton Falls.	.03	5.6	3.0	......	......
N-36	10	East Branch Mahoning River, at Newton Falls	.07	4.7	5.0	......	......
W-40	11	Mahoning River, at Warren water works	0.6	5.4	5.0	3.0	......
W-44	11	Mahoning River, at Warren water works	0.6	5.7	4.0	3.0	......
W-47	11	Mahoning River, at Warren water works	0.6	6.2	3.0	2.5	......
W-42	11	Filtered water at Warren water works	0.6	2.6	4.0	0.3	......
W-46	11	Filtered water at Warren water works	0.6	2.5	3.0	0.3	......
W-48	11	Filtered water at Warren water works	0.6	2.5	4.0	0.3	......
W-51	12	Filtered water at Warren water works	0.6	2.3	3.0	0.2	......
W-43	12	Warren water supply, tap at Park Hotel	0.6	3.8	5.0	0.3	......
W-30	11	Mahoning River, 600 ft. below Warren sewers	0.6	5.3	3.0	......	......
W-31	11	Mahoning River, 600 ft. below Warren sewers	0.4	5.6	3.0	......	......
W-32	11	Mahoning River, 600 ft. below Warren sewers	0.8	5.8	4.0	......	......
W-33	12	Mahoning River, 600 ft. below Warren sewers	0.6	6.2	3.0	......	......
N-50	11	Mosquito Creek	.02	6.6	2.0	......	......
N-51	11	Meander Creek	.06	6.5	5.0	......	......
N-52	11	Mahoning River, near Niles water works station	.04	2.6	3.0	......	......
N-53	12	Niles water supply, tap at Allison Hotel	.03	7.4	4.0	0.3	......
L-55	12	Mahoning River, below Lowellville dam	2.0	9.3	7.0	......	......
N-60	15	Mahoning River, near Niles water works station	0.4	6.1	2.0	......	67
N-61	15	Mahoning River, near Niles water works station	0.4	6.3	4.0	......	61
N-62	15	Mahoning River, near Niles water works station	0.4	6.6	3.0	......	57
N-63	16	Mahoning River, near Niles water works station	0.4	7.2	3.0	......	48
N-65	15	Mahoning River, below Niles, near Erie R. R.	0.4	6.2	3.0	......	53
N-66	15	Mahoning River, below Niles, near Erie R. R.	0.4	6.9	6.0	......	58
N-67	15	Mahoning River, below Niles, near Erie R. R.	1.[illegible]	7.0	4.0	......	46
N-68	16	Mahoning River, below Niles, near Erie R. R.	0.4	7.3	2.0	3.0	43
N-75	15	Niles water supply, tap in force main near pump	0.4	1.4	26.0	0.8	140
N-76	15	Niles water supply, wells Nos. 2, 3, 4	0.6	1.7	33.0	0.8	150
N-77	15	Niles water supply, tap at McGurk Hotel	0.6	1.1	28.0	0.8	150
N-78	15	Niles water supply, tap in force main near pump	0.4	4.8	19.0	5.0	57
N-79	15	Niles water supply, tap at Allison Hotel	0.4	4.7	19.0	5.0	57
G-70	15	Mahoning River, below Girard	0.4	5.6	5.0	......	67
G-71	15	Mahoning River, below Girard	0.6	6.1	4.0	......	60
G-72	16	Mahoning River, below Girard	0.6	6.8	4.8	......	49
Y-80	17	Mahoning River, above Youngstown at Briar Hill	1.2	5.7	3.0	2.0	......
Y-81	17	Mahoning River, above Youngstown at Briar Hill	0.4	5.8	4.0	2.5	......
Y-82	17	Mahoning River, above Youngstown at Briar Hill	1.2	6.4	3.0	2.5	......
Y-83	18	Mahoning River, above Youngstown at Briar Hill	......	6.4	3.0	4.0	......
Y-85	17	Mahoning River, at Youngstown water works	4.0	6.8	3.0	......	52
Y-88	17	Mahoning River, at Youngstown water works	0.2	6.6	4.0	......	42
Y-91	17	Mahoning River, at Youngstown water works	0.2	6.8	3.0	......	45
Y-93	18	Mahoning River, at Youngstown water works	0.6	7.1	2.0	......	46
Y-86	17	Youngstown water supply, at filter plant	......	2.6	2.0	......	76
Y-89	17	Youngstown water supply, at filter plant	......	1.6	3.0	......	67
Y-92	17	Youngstown water supply, at filter plant	......	1.8	2.0	......	63
Y-94	18	Youngstown water supply, at filter plant	......	1.7	4.0	......	67

RESULTS OF LABORATORY ANALYSES—THIRD EXAMINATION—(Continued.)

No. of Samp.	Date. 1909.	Sources of Samples.	N. as Free NH_3.	Oxyg. Cons.	Chlorine.	Iron (Fe).	Sulphates (SO_4).
Y-100	Feb. 17	Mahoning River, below Youngstown at Haselton	......	6.7	3.0	3.0	46
Y-101	17	Mahoning River, below Youngstown at Haselton	......	6.1	2.0	2.0	50
Y-102	17	Mahoning River, below Youngstown at Haselton	......	6.1	4.0	4.0	50
Y-103	18	Mahoning River, below Youngstown at Haselton	......	6.6	4.0	3.0	38
S-105	18	Mahoning River, above Struthers......	......	6.3	4.0	3.0	47
S-106	18	Mahoning River, above Struthers......	1.2	6.7	5.0	2.6	46
S-107	18	Mahoning River, above Struthers......	......	6.8	5.0	2.0	46
S-108	19	Mahoning River, above Struthers......	......	7.0	4.0	3.0	48
S-110	18	Mahoning River, below Struthers......	......	6.2	3.0	......	46
S-111	18	Mahoning River, below Struthers......	0.8	6.2	3.0	......	47
S-112	18	Mahoning River, below Struthers......	0.8	6.2	5.0	......	43
S-113	19	Mahoning River, below Struthers......	......	6.0	4.0	......	53
L-115	18	Mahoning River, 400 ft. below Lowellville dam	0.8	6.5	4.0	......	55
L-116	18	Mahoning River, 400 ft. below Lowellville dam	0.8	6.3	4.0	......	47
L-117	18	Mahoning River, 400 ft. below Lowellville dam	0.8	6.5	5.0	......	46
L-118	19	Mahoning River, 400 ft. below Lowellville dam	1.2	4.6	5.0	......	52

ANALYSIS OF SAMPLE OF DEHAIRING LIQUOR FROM THE OHIO LEATHER COMPANY'S WORKS AT GIRARD.

(PARTS PER MILLION.)

Number of sample	8038
Date of collection	Oct. 9, 1908
Oxygen consumed	374.
Total solids	13010.
Loss on ignition......	287.
As_2O_3	19.8

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*See report of O. S. B. of H., 1890, p. 95.

REPORT OF AN INVESTIGATION OF THE UNSANITARY CONDITIONS AT THE GIRLS' INDUSTRIAL HOME NEAR DELAWARE.

Under date of September 27th, 1909, the Secretary and the Acting Chief Engineer of the State Board of Health, Mr. Paul Hansen, made an investigation of the sanitary conditions at the Girls' Industrial Home near Delaware. The investigation was made at the request of Mr. Scott D. Webb, superintendent of the institution. Some weeks prior to this an outbreak of typhoid fever having occurred at the Home, the Superintendent requested the Board to make an investigation, and determine, if possible, the cause thereof. This investigation was promptly made, and while the cause was not absolutely located, it was deemed probable that the use of polluted river water for drinking purposes was responsible for the outbreak.

The Girls' Industrial Home was established in 1869, and many of the buildings now in use were erected soon after that time, and have not been greatly improved since. At present time there are about five hundred pupils, and about fifty officers, teachers, housekeepers, attendants, and other employes at the institution. The Home includes one hundred and eighty-nine acres of land on the west bank of the Scioto River, about 18 miles above Columbus. The present buildings comprise an administration building, school house, assembly hall, hospital, industrial school building, chapel, laundry, power house, and nine cottages. There are a few small buildings of minor importance. The site is well chosen, and comprises a gently sloping tract adjacent to the river. The buildings are located at such an elevation as to give them a commanding view over the picturesque Scioto valley. All natural conditions are favorable to make the Home ideal in its location as regards health, with the one exception of a suitable water supply.

WATER SUPPLY.

The water supply at present used by the institution is on the dual plan. For drinking purposes water is obtained from a so-called spring which in reality is a deep well in limestone. The water is under enough artesian pressure to cause it to flow from the well mouth. The flow of water is utilized to operate an hydraulic ram which supplies a marble bowl used as a drinking fountain. The water is also pumped to the various buildings through a system of small pipes. This water is of excellent quality from a sanitary point of view, but it has a taste and odor of sulphur which to many is objectionable. It is much too hard for domestic purposes or for use in boilers and also contains enough iron to render it objectionable on account of staining of plumbing fixtures and fabrics.

For all purposes other than drinking, water is derived from the Scioto River. The intake structure consists of a brick cistern about 20 feet by 25 feet in plan and 10 feet deep. The sides and roof of this cistern are braced by two brick walls arched at the bottom so as not to interfere with the free passage of water. Manholes are provided in the roof to give accessibility to the interior. No bottom is built in the cistern so that the river water may percolate through the gravel deposits and possibly also through the rock, and thereby be to a degree purified. The filtration obtained in this manner is not efficient and, furthermore, the yield is insufficient to meet all the demands of the institution. To make up the deficiency the suction line has a branch extending directly to the river. This direct suction is used constantly during low stages of the stream and occasionally during higher stages. At this point the Scioto River shows no gross or constant contamination but the unprotected condition of the watershed and the fact that there are numerous points where pollution may readily enter, renders dangerous contamination at times inevitable. In all, or practically all, of the cottages both the river and spring waters are available, and may be obtained from three faucets placed in a row near together. Some of the girls do not like the spring water on account of its sulphur taste, and make use of the river water faucet for drinking purposes. This has been done in spite of the fact that the use of this water has been forbidden, and signs placed calling attention to it as the probable cause of typhoid fever. As the use of this water may at any time be productive of disease, some plan should be adopted to render its use for drinking purposes impossible. One method suggests itself which is in use at the Ohio Soldiers' and Sailors' Orphans' Home near Xenia where there is also a dual supply. This consists in having the polluted water made available only through hot water faucets. While feasible this method is not without serious objections. First, it would involve the use of excessively hard water for toilet and other purposes where a hard water is objectionable. The fact that the hard water would generally be mixed with a large proportion of the softer river water would help matters somewhat, but in this instance the river water is already far harder than is desirable. Again this arrangement on account of the larger quantities of well water that would be involved would require a considerable enlargement of present piping and pumps used for its distribution. If this plan is not feasible, the danger of the present system could be much lessened by changing the location of the drinking water faucet, and by attaching a small wire basket or some device to the impure water faucets that would make it difficult, or impossible, to drink directly from them.

The best method to insure the non-use of polluted river water would be to filter it. The success of filtration, however, depends on efficient operation of the filtration plant and this it is often difficult to obtain either in institutions or small communities. On the other hand, it is believed that the institution could well afford to employ an intelligent and conscientious man to have complete charge of the water works, including the operation of the filter plant and the care of pipe lines and plumbing. The engineering department of the State Board of Health is in a position to design a plant from which good results can be assured and train a man in its proper operation.

Some better provision should be made for the storage of water. Storage on the distribution system is afforded by a standpipe only 10 feet in diameter and 30 feet high, or having a capacity of but 17,500 gallons. It is also understood that this standpipe is in a leaky condition. The average daily consumption at the present time is something over 50,000 gallons, a rather high figure. Because of insufficient storage capacity or the leaky condition of of the standpipe, or both, the pressure in the pipes is lowered to such an extent in the morning that it is often impossible to get hot water on the ground floor of most of the cottages for bathing and washing purposes. The weakness of the water system for fire protection is evident from the above described conditions. An elevated tank with a capacity of at least 50,000 gallons and at least 80 feet in height should replace the present standpipe.

PLUMBING AND SEWERAGE.

The plumbing and sewerage of the institution admits of no serious criticism. For the most part the plumbing is substantially done, and in accordance with modern standards. In the detention cottage old fashioned plumbing is still in use, but this is soon to be replaced. In one or two places leaks were found, but this is always liable to happen in a large institution. In some of the cottages the toilet rooms are poorly lighted and ventilated. This is especially true of some of the bath rooms used by the officers of the institution. In cottage No. 8 the toilet room contained a loosely boarded up sump which has become quite filthy. In none of the cottages was hot water available for bathing purposes, and this has to be carried to the tubs in buckets. The sewerage system has but recently been remodeled and sewage purification works have been installed. At present sanitary sewage is maintained strictly separate from storm water drainage and is conveyed through a system of vitrified pipe sewers to the purification plant which is located near the southern edge of the state's property. A very high degree of purification is effected by a series of devices including the following: Preliminary sedimentation, stone sprinkling or precolating filters, secondary sedimentation, intermittent sand filtration, disinfection and final sedimentation and reaction. Means for disinfection were installed as an emergency device in case of severe epidemic to prevent the discharge of disease germs into the Scioto River from which the Columbus water supply is drawn. At the present time the plant is being well cared for and is producing a clear effluent without appreciable odor.

HEATING AND VENTILATION.

The heating system in the past has been very inadequate, but a new plant which is now being installed is expected to meet all the needs of the institution. The ventilation of many of the cottages is poor, and disagreeable odors were noticeable in many of the old cottages. The buildings other than the cottage buildings are in good condition, with the exception of the laundry, to be referred to later. The new hospital which contains accommodations for about thirty patients is a thoroughly modern building, and in design meets practically all of the most rigid requirements, with the one exception that a morgue, or dead room, has not been provided. The new industrial building is also a good building, well equipped for the teaching of cookery and sewing. The school building was not inspected, but it previously had been by a representative of the Board, and is up to the average of school buildings. A new laundry is badly needed. The present one is not large enough, nor does it contain equipment sufficient to handle all of the work of the institution. Most of the linen on the beds had a dark unwholesome appearance which is probably attributable to overcrowding of laundry facilities. Part of the difficulty is probably due to the hard, and often turbid, water supply. There are two laundry buildings adjoining each other, the old and the new. The new building is a one story affair, substantially constructed, and well lighted. It is devoted entirely to ironing. The old building contains all the washing machinery and the machine irons. The flooring is old, broken and water-soaked. Below it is a dark, wet and inaccessible basement which receives considerable laundry water from above.

Of the nine cottages there are two new ones, namely, No. 7, built three years ago to take the place of one destroyed by fire, and the Honor Cottage just recently completed. These are up to date in every respect, and admit of no unfavorable criticism unless it be relative to the location of baths, lavatories, and water closets in basement rooms which are not thoroughly lighted. Two of the old cottages, namely, No. 2 and No. 6, have been remodeled so as to make them fairly satisfactory. They are still lacking, however, as regards proper heating and ventilation, and the sleeping rooms are for the most part too small. The remaining five cottages are unqualifiedly bad. The prison idea undoubtedly prevailed when these buildings were constructed. Most of the sleeping rooms are but 6 feet in width by 8 feet in length, with an air space of but 480 cubic feet, or about one-third the space that hygienists generally recognize as desirable for one person. A small window affords light and air to these bed rooms, but as they are not heated, nor is there any heat in the corridors into which they open, it is highly probable that during the winter season these windows are kept closed by the occupants. It would be bad enough if but one person were required to occupy this cell, for it amounts to but little more, but when it is considered that each of these tiny rooms is occupied by two girls the lack of air space will be appreciated. These rooms are so narrow that but a 3-foot cot can be used in which two girls are obliged to sleep. On entering these old cottages disagreeable odors were in all cases perceptible in the hallways and rooms. The exact origin of these odors could not be ascertained. The floors are generally of yellow pine, greatly splintered and roughened by wear. It is almost impossible to keep them clean, and when scrubbed they absorb the soapy waters which no doubt in part is the cause of the bad odors noticeable. The walls are mostly papered, generally in hideous designs and colors. In many places the plastering of ceiling and walls has fallen away exposing large areas of lathing. All of these five cottages have unpaved cellars, and the fissures in the ground and footprints show that at times they contain standing water. While some of the cellars of these cottages are fairly well lighted, most of them contain numerous rooms and niches into which the light never penetrates. The darkest cellars were generally fonnd to be greatly littered with rubbish, including old tin cans, broken glass, and crockery, old brooms, paper, wood, and even rags.

The common complaint in all of these older cottages is that they are infested with rats, roaches, and bed bugs, and it has seemed impossible to get rid of them. It is not impossible that the vermin have had something to do with the spread of typhoid fever from one cottage to another. Each cottage does its own cooking for the inmates, and keeps a supply of uncooked food, and frequently in the cellar. Rats which frequently crawl into sewers might possibly contaminate food so kept. Until recently none of the older cottages was screened, and at the present time they are only partially so. On account of the flies all of the dining rooms were found closed, and with the window shades drawn. No doubt the foul odors and dampness would be dissipated to a considerable extent if the sun's rays and fresh air were permitted to freely enter these cottages. The furnishings in the older cottages are of the very poorest description imaginable, and are old and dilapidated. Some of the beds are scarcely able to stand up, and many of the mattresses are worn out and thin. All bureaus are mere child's toys, and are made up in the cheapest manner possible. Poor furnishings are also found in the rooms of the officers, though they are not so entirely unfit for use as those allotted to the pupils. The buildings and furnishings could not have been calculated to render the homes of these girls more unattractive.

In conclusion it may be said that with minor exceptions the sanitary conditions at the Girls' Industrial Home are the best possible under the circumstances. The five old cottages are a disgrace to the State of Ohio, and they should be completely remodeled, or replaced by new ones. Some steps should be taken to change conditions as regards the water supply. The greatest evil no doubt is due to the wretched overcrowding. In some of the cottages the extreme has been reached of having three girls in one bed, and these beds hardly exceed four feet in width. This evil extends to the newer cottages, as two girls occupy each bed room. The overcrowding is not so marked here as the rooms and beds are larger. Not only is the spread of disease promoted by the practice of causing these girls to sleep together but the very object of the institution may be defeated by bringing girls of widely different moral caliber into such intimate contact. Our thanks are due to Mr. Scott D. Webb, Superintendent, who offered us every facility in making this investigation.

A copy of this report was furnished the Superintendent of the Home and Governor Judson Harmon.

REPORT OF AN INVESTIGATION OF TYPHOID FEVER EPIDEMIC AT THE GIRLS' INDUSTRIAL HOME, DELAWARE.

On August 10th, 1909, a communication was received by telephone from S. D. Webb, Superintendent of the Girls' Industrial Home at Delaware, stating that there was an outbreak of typhoid fever at the institution and requesting an investigation of the cause of the epidemic. The assistant engineer visited the institution on August 11th, investigated conditions and submitted the following report.

On August 11th, eleven girls were confined in the hospital of the institution ill with typhoid fever: They were under the care of Dr. A. J. Wiley of Delaware, acting physician for the Home. The hospital, a modern building, dedicated in February of this year, is in charge of three graduate nurses and the typhoid patients are cared for in accordance with best hospital practice in these cases. All of the discharges were said to be thoroughly disinfected.

Each of the eleven patients has been subjected to substantially the same environment. The water, milk and vegetable supply, the liability by infection of flies and from all other possible sources apply with equal force to each of the patients. Detailed information relative to the different cases is shown in the following table:

DATA OF TYPHOID FEVER CASES.

Name.	Age.	Cottage.	Received in Hospital.	Health past 2 months.
B. H.	16	8	July 18th	Poor
M. C.	9	2	July 23d	Good
E. P.	19	4	August 8th	Good
A. T.	15	2	August 8th	Good
F. P.	12	2	August 7th	Good
A. H.	12	2	August 8th	Good
B. H.	12	2	August 5th	Good
H. R.	12	2	August 8th	Good
H. R.	18	4	August 6th	Good
A. C.	18	4	August 6th	Good
E. S.	16	4	August 6th	Good

Cases — Cottage 2	6
Cottage 4	4
Cottage 8	1
Total	11 cases.

According to Dr. Wiley, the clinical diagnosis of all these cases indicates typical typhoid fever of a severe type. Practically all the later cases entered the hospital with a high temperature. In most of the cases the attack was very sudden.

In addition to these cases now in the hospital, on August 8th the assistant matron of Cottage 8, in which there was a case of typhoid fever on July 23rd, was taken taken to a hospital in Delaware afflicted with the disease. It appears that this woman had recently returned to the institution from her home where there were two cases of typhoid fever. This case appears to be explainable as a contact case.

SUPPLEMENTARY INFORMATION.

On August 14th, word was received by telephone that two additional cases had appeared in Cottage 2, F. M., aged 11, August 12th, and A. H., age 10, August 11th. A. H. is a bed partner of F. P., taken to the hospital on August 7th.

On August 14th, two girls from Cottage 4 were sent to the hospital in a feverish condition. The diagnosis of these last two cases is not completed. There is no possible intercourse between the girls in cottages 2 and 4, neither as regards meals nor in the duties and activities of the Home.

POSSIBLE SOURCES OF INFECTION.

With a view to determining, if possible, the origin of the epidemic there were carefully investigated various features, such as the water supply, the milk supply, the sanitary sewerage, the disposal of garbage, uncooked foods, and flies.

WATER SUPPLY.

The water supply of the institution is on the dual plan; for drinking purposes from a spring, and for all other purposes from the Scioto River.

Spring Water. Water for drinking purposes is obtained from a white sulphur flowing spring, located in the bed of the Scioto River. The water rises from a depth of about 180 feet. The spring is cased and the water is under considerable artesian pressure. The overflow from the spring operates an hydraulic ram, which forces the water into a marble bowl at the bottom of which is the intake pipe which leads to the pump. The water is pumped through a 1¼-inch pipe into the spring water mains, which extend to practically all of the buildings of the institution; the excess pumpage overflows into the river.

River Water. For bathing and for the laundry, water is pumped to a standpipe, thence to a distribution system from an intake well sunk 10 feet beneath the bed of the Scioto River and on the bank of the stream. This intake is a brick cistern covered with an arched roof and is about 20 feet by 25 feet in plan and 10 feet deep. It is divided into three compartments by brick walls, each of which has near the bottom a semi-circular opening for the passage of the water. The cistern has no bottom so that river water enters from below and rises substantially to the same level as that in the river. Inspection manholes are provided over the ends of each of the three compartments. The suction of the pumps is located in one of the compartments and for emergency use is branched and extended directly to the bed of the river. This intake is ordinarily closed. At times of very low river flow it is necessary to draw directly from the river and for this purpose a small rock dam is usually thrown across the stream. It is stated that under very heavy drought it is also necessary to use this direct river intake.

The river water is pumped to a standpipe said to be 10 feet in diameter and 30 feet high. The capacity of this storage tank is about 17,600 gallons. According to the chief engineer of the institution, this tank is filled three times in 24 hours and always before nightfall to afford fire protection. According to these figures the average daily consumption of river water is about 53,000 gallons.

Cottage Water Supplies. Both the spring and the river water is piped to the several cottages. In the toilet room of cottage 2 there is a bank of ten bowls, each with two faucets all but one of which are of river water. The odd faucet which supplies the drinking water from White Sulphur Spring is provided with two drinking cups on chains. The length of the chains is such that either the spring water or the river water could be used to fill the cups. The remaining cottages have no drinking water in the toilet rooms but have kitchen sinks at which both kinds of water are available. Shower baths have been provided in cottages 1, 2, 3 and 7, and in the assembly hall. River water is provided for these baths.

It is stated that the girls will drink the river water and that it is difficult to prevent its use, although it is stated that they have been repeatedly warned against this practice. Many of the girls dislike the taste of the sulphur water and are loath to drink it. There is practically no storage of spring water and in case the single pump provided for furnishing this water is out of order, the river water is the only supply available.

Iron Spring. Just west of Cottage 8 and a short distance from Cottage 6 is a chalybeate, or iron spring, which is protected with a spring house and carefully cased. This water appears to be of good quality but it contains considerable iron. The footpath leading from Cottage 8 is well worn, suggesting that this water is frequently used by this cottage. This water is also used at times by Cottage 6.

Condemned Spring. On the southerly part of the grounds near the river is a spring said to have been condemned some time ago as being a suspicious water. The spring house is locked but the water is accessible at the end of a pipe culvert under the carriage road which leads to the sewage plant. It is probable that this water is but little used.

Milk Supply.

The milk used in the institution is obtained chiefly from the State's farm. Some milk is purchased from a farmer who lives about one-half mile east of the institution. Inquiry at this farm house revealed that there had been no sickness worthy of mention for some time. The milk cans used at the dairy department of the institution are washed at the central kitchen. Heated river water is chiefly employed.

SANITARY CONDITIONS.

The plumbing and sanitary conveniences in the building are of a modern type and in general conditions cannot be criticised in this regard. Just back of Cottage 2 is an old vault where there is provided a number of out-door closets. These closets are directly connected with the main sewer line and have no vents so that it is difficult to exclude sewer gas. The closets are said to be flushed occasionally. Under orders from Dr. Wiley the closet in the rear of Cottage 2 has been locked*.

GARBAGE DISPOSAL.

A short distance behind each cottage are two wooden barrels without covers used to store garbage. It is stated that these receptacles are cleaned each day. They are very unsightly and attract flies.

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*See report of O. S. B. of H. 1890, p. 95.

SCREENS.

When visited on August 11th practically none of the dining rooms and none of the living rooms was screened. Screens awaiting installation were noted outside some of the cottages. Large numbers of flies were noted on fly paper placed in the dining room of Cottage 2. It is evident that opportunity is at hand for the flies to enter the dining rooms during meals.

POSSIBLE CAUSES OF THE EPIDEMIC.

On reviewing the possible sources of infection just discussed, it is apparent that the water supply is a possible source. The polluted river water is available in all the buildings and in Cottage 2, where eight of the cases occurred, drinking water may readily be obtained from this source. The children in this cottage range in age from 8 to 16 years and some of them may not appreciate the danger incurred in the use of the river water. Spring water although colder, to some is very objectionable on account of the taste and odor. It is true, of course, that the epidemic is not distributed over the entire institution as would be the case in an epidemic conclusively attributable to a polluted water supply.

The milk appears to be above suspicion, there is little likelihood of a contact explanation and further, the uncooked foods served are eaten alike by all of the inmates of the Home. Although the dining rooms are not screened, it is not believed that the cases in cottages 2 and 4, of which all the earlier ones occurred within two days, could be attributed to infection carried by flies, since no cases developed in the other cottages.

There appears to be no relation between the cases which occurred on July 18th and the later cases. The case on July 23rd may possibly have caused some in Cottage 2. In almost all of the cases the patients were in good health prior to being taken sick.

It is quite possible that the presence in the cottages of polluted river water is the explanation of this epidemic. Arrangements were made for the collection of samples of water from one of the river water taps, spring water taps and from the iron spring. These samples were collected by Dr. A. J. Wiley on August 12th, 1909. The analyses are appended to this report. They do not reveal marked pollution in any of the three supplies of the institution. Coli were negative in 10 c. c. in all of the samples. It is, of course, merely a coincidence that so few bacteria and no coli were found in the river water, which, is always polluted and unfit for drinking purposes by virtue of the dicharge of the Marion sewage and that from Marysville and other cities on the watershed of the Scioto River and Mill Creek above the intake of the Home. The spring water shows quite high numbers of bacteria and possibly the somewhat high results are attributable to the fact that the samples were two days in reaching the laboratory.

It is stated in previous analyses that all the water from the sulphur spring and from the iron spring have shown these waters to be of excellent hygienic quality. It has been realized for some time that there is great danger in the use of polluted Scioto River as a general water supply for the institution, as was pointed out in a report of an inspection made by a committee of the Board on August 23rd, 1890.

The evidence obtained during inspection at the institution did not suggest the actual cause of the epidemic. It is true that a polluted water supply is available in all of the cottages and there is strong evidence to support the view that some of the girls at times use this water for drinking purposes. If the epidemic is to be considered water-borne it is difficult to explain why cases have not developed in all of the cottages of the institution.

INSPECTION OF AUGUST 18th, 1909.

On August 18th, 1909, there was made a second visit to the insituation with a view to tracing if possible, some connection between the cases that developed in July and the later cases, especially any possible relation between the assistant matron of Cottage 8 and the subsequent epidemic.

Careful inquiry of the matron and assistants in both cottages 2 and 8 failed to show any tangible relation between Miss L., assistant matron of Cottage 8, and the other cases. Miss L. was not on especially intimate terms with the officers of either cottages 2 or 4 and did not visit in these cottages. There appears to be no possible explanation of the epidemic on the basis of the carriage of the infection by Miss L.

Efforts to trace a relation between the clothing worn by Miss L. and the case which developed two weeks later were unsuccessful. The clothing of the different cottages is washed at different times and the garments are not mixed. There are certain regular laundry girls who work in the laundry each day. None of these girls is ill with the disease. One case, E. S., which developed in Cottage 4, was a girl who had charge of the collection of the soiled clothing.

Special inquiry was made as to new officers and the question of their health prior to their arrival at the institution. In general no possible sources of infection could be discovered. It has further developed that there is no spring water accessible in the toilet room of Cottage 4 and that the only spring water faucet is in the kitchen and from it all the drinking water is carried to the living rooms.

Although the specific cause of the typhoid fever in the institution was not developed during the first, nor this, the second inspection, a source of pollution of the Scioto River about two weeks before the outbreak of the fever was developed. It appears that Miss L., assistant matron at Cottage 8, was removed to the hospital in Delaware ill with typhoid fever about August 8th. Miss L. returned to the institution on

July 13th and was taken to Delaware on August 8th. She had been at home taking care of the house during the illness from typhoid fever of two members of her family. One was taken ill April 17th and confined for five weeks, the other was taken ill May 29th and confined for seven weeks. Miss L. herself was taken ill practically at the end of the usual incubation period and her case seems clearly to be explainable on the contact basis. The total number of cases reported to August 18th was 14.

CONCLUSIONS AND RECOMMENDATIONS.

The investigation of the epidemic of typhoid fever at the Girls' Industrial Home, Delaware, has not definitely revealed the cause of the outbreak. The presence of a polluted water supply in each cottage and the probability that the water is at times used by the children is possibly the cause of the epidemic. However, the fever has not been common to all the cottages as would be true if the water supply were responsible.

While the investigation was thus inconclusive, certain features as to the Home suggest several recommendations along the line of a sanitary betterment of present conditions.

1. That serious consideration be paid to the question of an improved water supply. A single supply of a safe water would prevent the future occurrence of a water-borne typhoid epidemics,
2. That all the kitchens and dining rooms be screened.
3. That covered iron rectpacles be provided for garbage.
4. That until arrangements can be perfected for improving the present water supply, placards be displayed conspicuously in all of the cottages warning the children against the use of the river water for drinking, and
5. That no river water faucet be placed adjacent to a spring water faucet.

APPENDIX.

Result of Analyses of Samples of the Sources of Water Supply.

No. of Sample	8877	8878	8879
Date of Collection	Aug. 12, '09.	Aug. 12, '09.	Aug. 12, '09.
Source	Scioto River.	Hydrant Spr.	Iron Spring.
Color			
Turbidity	40	80	150
Sediment	heavy	v. heavy	v. heavy
Odor	aromatic	none	none
Dissolved oxygen			
Oxygen consumed	5.50	3.20	1.60
Nitrogen as—			
Albuminoid Ammonia	0.296	0.090	0.130
Free Ammonia	0.02	0.24	0.36
Nitrites	none	none	none
Nitrates	none	none	none
Chlorine	14.0	64.0	8.0
Alkalinity			
Total	210.0	318.0	434.0
Phenol			
Caustic			
Incrustants			
Sulphates			
Total solids	492.0	1,187.0	1,459.0
Loss on ignition			
Iron			
No. of bacteria per c.c.	960	2,200	720
Colon Bacilli	Neg. in 10 c.c.	Neg. in 10 c.c.	Neg. in 10 c.c.

A copy of this report was sent to the superintendent of the Home, and especial attention was called to the recommendations made. As the germ that produces typhoid fever sometimes remains in both the fecal and urinary dicharges for sometime after recovery, he was advised that it would be well to have these discharges disinfected in all cases for several weeks after they are apparently well.

MATERNITY BOARDING HOUSES AND LYING-IN HOSPITALS.

INSPECTION OF MATERNITY BOARDING HOUSES AND LYING-IN HOSPITALS.

Preliminary to the work of inspection of maternity boarding houses and lying-in hospitals was the preparation of suitable blanks, records and licenses. In this it was found on correspondence with other states that Ohio was inaugurating a new work and much time was consumed in meeting the requirements prescribed by law. It was necessary to prepare a register and a series of six blanks, copies of which are appended.

It will be noted that these blanks are really parts of the register kept by the licensed proprietor and when completed makes it possible for the State Board of Health to keep a duplicate.

While the printed matter was being prepared the following series of letters were addressed to chiefs of police, probate judges, juvenile courts, humane officers, secretaries of county medical societies and boards of health and health officers:

To the Chief of Police:

"By an act of the last legislature the State Board of Health is required to license, after inspection, all maternity boarding houses and lying-in hospitals in this state. The purpose of this act is to protect the women who give birth to children in such places and to see that children born there are properly cared for and properly accounted for.

From statements made at the time the passage of this act was being urged, and from some investigations since, we have reason to believe that there are many such places in this state that are thoroughly disreputable and should be done away with.

The Board will adopt rules and regulations governing these places, with especial reference to their hygienic conditions, and will refuse to license those that cannot come up to these minimum requirements. We hope in this way that the worst of these may be put out of business.

It is quite probable that many of them are known to but few outside of the police, and we therefore appeal to you, hoping to have your assistance in locating any such places that may be within your jurisdiction, in order that the required inspection may be made.

I may say that it is not to be the policy of our Board to interfere in any way with places of this character that are carrying on their business in a legitimate manner.

I enclose a copy of the act.

Yours truly,
C. O. Probst,
Secretary."

To Probate Judges, etc.:

"By an act of the last General Assembly the State Board of Health is required to license, after inspection, all maternity boarding houses and lying-in hospitals.

From evidence presented in urging the passage of this act, there would seem to be a number of disreputable and dangerous places of this kind in the state that should be put out of business. The Board is proposing to adopt rules and regulations governing such places, and to refuse to grant licenses to those that cannot meet these minimum requirements. We hope in this way to abolish the worst of them.

We expect to find it difficult to learn of the location of such places; and believing that you would be interested in this matter, I have taken the liberty of asking you for any information you can give me that will enable us to locate places of this character in your county.

The Board will appreciate very highly any assistance you may be able to give us in the enforcement of this act.

I enclose a copy of the act in question.

Very truly yours,

C. O. PROBST,

Secretary."

"*To Boards of Health and Health Officers:*

SIRS: I desire to call your attention to a law enacted by the last legislature requiring all maternity boarding houses and lying-in hospitals to be inspected, and after such inspection, to be licensed by the State Board of Health.

You will note that this law requires that all applications for licenses "shall first be approved by the local board of health of the city, village or township in which such maternity boarding house or lying-in hospital is to be maintained."

The law further provides that the local board of health may require that such license be posted in a conspicuous place, and that the State Board of Health and the local board of health shall annually and may at any time, visit and inspect the premises so licensed.

You will also note that the law requires that the licensed proprietor of a maternity boarding house and lying-in hospital shall report to the local board of health within twenty-four hours, the name of every woman or child admitted, the birth of every child, the death of any inmate, with name of attending physician; also that the county coroner may be called if circumstances warrant, and finally that such proprietor shall notify the local board of health when any child is given out, taken away or adopted.

I enclose a copy of the law and earnestly desire that you may familiarize yourself with its provisions, to the end that the State Board of Health may enlist your intelligent and active co-operation.

Copies of blanks and the rules and regulations adopted by the State Board of Health governing such institutions will be sent to you in a few weeks.

The State Board of Health has appointed a special officer whose duty it shall be to personally inspect all maternity boarding houses and lying-in hospitals before a license is issued. I would suggest that the inspection required by law to be made by your local board of health be deferred until our inspector's visit so that both inspections may be made at the same time.

Any information that you can furnish regarding the location of such boarding houses and hospitals will be greatly appreciated, and will render possible the early enforcement of a law which, I believe will be productive of much good.

Very respectfully,

C. O. PROBST,

Secretary."

The work of inspection was begun in Hamilton County where effort was made to visit every place, private residence or institution where children under two years of age were received, cared for or treated and every place where women were received during pregnancy. This included general hospitals with maternity wards, though these are exempted from the provisions of the act, and many free institutions also exempt.

The work was carried on in like manner in the larger counties of the state while replies to our letters of inquiry were being received. Later, the following more specific letter was sent to health officers, and from these some information was received:

> "I desire again to call your attention to the law passed at the last session of the legislature providing for inspection and license of maternity boarding houses and lying-in hospitals. Will you kindly furnish me at your earliest convenience with the following information:
>
> 1. Name and address of public and private lying-in hospitals in your city and county.
> 2. Name and address of incorporated hospitals in your city and county receiving maternity cases.
> 3. Name and address of individuals who board children under the age of two years, unattended by parents or guardians.
> 4. Name and address of all institutions who receive, care for or treat children under the age of two years.
>
> Thanking you in advance for the above information, I am,
>
> Very truly yours,
> H. M. Platter,
> *Medical Inspector.*"

It was remarkable, however, how little information is attainable regarding the baby farm or the irregular lying-in hospitals. Private lying-in hospitals are, however, largely a thing of the past. In nearly every county one, or more, general hospital receives maternity cases and gives them proper care. There still remains, however, need of places where dependent children, legitimate and illegitimate may be cared for while the parent earns a livelihood. In the larger cities there are several institutions where the child can be cared for provided the mother decides to give it up. As a rule there are very few proper places where infants can be boarded or farmed and for such as these some provision should be made. As an obstacle in obtaining the proper kind of baby farm, one woman who has been giving excellent care to these helpless little ones for years has stated that she will not continue in the work for another year because she has lost some $300.00 during the year by the parent abandoning the babe, usually illegitimate, after paying its board for several weeks and establishing a credit. There remains no redress for her and she can only surrender the babe to the juvenile court. Until some protection can be given proper people to engage in the work, the establishment of ideal baby farms will be much hindered.

Much time has been lost by the inspector in visiting institutions which upon investigation were exempt from the operation of the law. In the beginning all hospitals receiving maternity cases were visited but an opinion rendered by the Attorney General, herewith submitted, exempts them from inspection and license.

"DECEMBER 26th, 1908.

DR. C. O. PROBST, *Secretary State Board of Health*, Columbus, Ohio.

DEAR SIR: I have your inquiry of the 17th instant requesting an official opinion upon the following question:

In the inspection and licensing of maternity boarding houses and lying-in hospitals, it is contended that section 1 of the act of February 18th, 1908, (99 O. L., 13), exempts from the provisions of the law hospitals accepting all classes of cases, or those which may rightfully be denominated regular hospitals as distinguished from lying-in hospitals.

The section of the act in question is as follows:

> "Whoever for hire, gain or reward, receives, cares for, or treats within a period of six months, more than one woman during pregnancy, or during or after delivery, except women related by blood or marriage; or whoever for hire, gain or reward has in his custody or control at any one time two or more infants under the age of two years, unattended by parents or guardians, for the purpose of providing them with care, food and lodging, except infants related to him by blood or marriage, shall be deemed to maintain a maternity boarding house or lying-in hospital. Provided, however, that nothing herein shall be construed to prevent a nurse from practicing her profession under the care of a physician in the home of a patient, or in a regular hospital other than a lying-in hospital."

The statute nowhere contains a definition of a "regular hospital," but it is evident that there must be in the professions of medicine and nursing a wide distinction between a so-called "regular hospital" and that of a "lying-in" hospital. The definition is given in the foregoing section of the law as to what shall be deemed a maternity boarding house or lying-in hospital. The exemption is specifically made of those nurses practicing their profession under the care of a physician in the home of a patient or in a regular hospital other than a lying-in hospital, and the distinction is further observed in section 2 of the act wherein it is provided that your board shall have the power to grant a license to maintain a maternity boarding house or lying-in hospital. Such power does not extend to licensing regular hospitals, although such hospitals may accept, nurse and otherwise care for maternity cases. The evil sought to be controlled does not apply to that class.

I am of the opinion that the right exists in the state board of health to classify, for the purposes of such act, all such institutions or hospitals as either "regular hospitals" or "maternity boarding houses" or "lying-in" hospitals. Such classification, if made by your board upon the basis of the number and class of cases accepted for treatment therein, as well as upon other established tests pertaining to such practice, would, in my opinion, be sustained by the courts of the state. Those institutions which met the requirements pertaining to "regular hospitals" would be exempt from the provisions of the act in question.

Yours very truly,

W. H. MILLER,

Assistant Attorney General."

Again many institutions have been visited and found to be maintained without hire, gain or reward and are, therefore, exempt.

Prosecutions have been instituted by the local officials in Hamilton, Cuyahoga and Preble counties for violations.

In Hamilton County, Annie Florein was arrested for keeping a maternity hospital without license and bound over to the grand jury. Again in May she was arrested for accepting a fee for providing a home for a child and again bound over to the grand jury. Here the cases remain, misdemeanors caught in a heavy docket and in all probability will not be reached until the witnesses are dead or are lost sight of.

The probate judge of Preble County is at present the ward of an abandoned babe which was brought to Ohio by the wife of the proprietor of a lying-in hospital in Covington, Kentucky. Because no fee was received it is extremely unlikely that a case can be made.

These cases are cited to show the need of amendments to cure defects in the law and render conviction possible. As it now stands it is extremely difficult to bring a case to trial or to obtain the necessary data for a successful prosecution. The Preble County case would indicate that Section 10 of the Act should be rewritten eliminating the words "hire, gain or reward." I find it not at all uncommon for general hospitals to give a babe into the custody of persons without asking any questions. But recently a juvenile judge reclaimed a babe from the proprietress of a house of ill fame, who had obtained it from a general hospital. Since no fee was asked or received there was no violation of the law.

To make the law effective Section I should be amended as follows:

SECTION 1. Whoever receives *for care or treatment* within a period of six months, more than one woman during pregnancy, or during or after delivery, except women related by blood or marriage; or whoever has in his custody or control at any time two or more infants under the age of two years, unattended by parents or guardians, for the purpose of providing them with care, food and lodging, except infants related to him by blood or marriage, shall be deemed to maintain a maternity boarding house or lying-in hospital. Provided, however, that nothing herein shall be construed to prevent a nurse from practicing her profession under the *direction* of a physician in the home of a patient, or in a regular hospital other than a lying-in hospital. *The provisions of this section shall not apply to any charitable organization, society or institution having the care of children under its control duly incorporated under the laws of Ohio or juvenile court.*

Section 8 should give the inspector the right to inspect places which have been refused license and grant him the right to inspect any house where complaint is made that a lying-in hospital or baby farm is being conducted. Section 10 should be rewritten requiring the individual, organization or institution to obtain the written consent of the probate or juvenile courts before a child under the age of two years is given into the permanent care or control of another; and finally, Section 15 should be amended eliminating the imprisonment from the penalty thereby giving final jurisdiction to justice courts in order that cases may be promptly brought to trial. [Ed. These section were amended.]

The work of the inspector by counties is herewith appended with names of institutions and individuals visited. A number of these are exempt from license under the law, the reasons for exemption are assigned.

Adams County — Not visited — health officers and other officials report none.
Allen County — Lima Hospital (has maternity department) — exempt, general hospital.
  Mrs. J. T. Black, 633 West Spring St., Lima — licensed.
  Bethesda Home (Mennonite) German Tp. — exempt, free.
Ashland County — Not visited — county officials report none.
Ashtabula County — Not visited — county officials report Ashtabula Hospital — exempt.
  Children's Home — exempt.
  Ashtabula Home — exempt.
Athens County — Not visited — officials report Nelsonville Hospital — exempt.
Auglaize County — Not visited — officials report none.
Belmont County — Belmont County Infirmary — exempt, free.
  Children's Home — exempt, free.
  Martins Ferry Hospital — exempt, general hospital.
Brown County — Not visited — officials reported none.
Butler County — Mercy Hospital, Hamilton — general hospital — exempt.
  Mrs. Nola Pavey, Hamilton — rejected.
  Helping Hand Society, Hamilton — exempt, free.
  County Infirmary, Hamilton — exempt, free.
Carroll County — Not visited — officials reported none.
Champaign County — Niles Sanatorium, Urbana — general hospital — exempt.
Clark County — Springfield City Hospital — general hospital — exempt.
  Children's Home — exempt, free.
  Door of Hope, Springfield — exempt, free.
  Mrs. Elida J. Hill (Private Hospital) — exempt, general hospital.
Clermont County — Not visited — officials reported none.
Clinton County — Not visited — County Infirmary — exempt, free.
  Children's Home — exempt, free.
Columbiana County — Not visited — officials reported none.
Coshocton County — Not visited — officials reported none.
Crawford County — Bucyrus Hospital — general hospital, exempt.
Cuyahoga County — Cleveland — St. Anne's Infant Asylum — licensed.
  Infant's Rest — licensed.
  Cleveland Protestant Orphanage — Take children over 2, exempt.
  Miss Annette Chase — licensed.
  Salvation Army Maternity Hospital — licensed.
  Mrs. Minnie Knapp — licensed.
  Mrs. Amelia Eble — licensed.
  The Jones Home — Take children over 5 — exempt.
  Maternity Hospital of Cleveland — licensed.
  Dr. Menough, 1774 East 55th Street — Investigation — does not take cases.
  Dr. C. Baker, 10405 Marlowe Avenue — rejected.
  Mrs. Ida Dewey — licensed.

Mrs. O'Toole, 2651 St. Clair Avenue — Investigation, does not take cases
Mrs. Emma Biggs — licensed.
Mrs. Smith, Midwife, 4227 Lorain Ave. — Does not take cases.
Mary May, Midwife, 1212 Auburn Avenue — Does not take cases.
Mrs. M. A. Lerch, 2312 Kinkee — No action by local board of health.
The Retreat, 4916 St. Clair Avenue — free, exempt.
Mrs. Leah Martin — licensed.
Mrs. E. B. Decker, 2981 East 81st Street — Declined to apply.
St. Clair Hospital — general hospital — exempt.
Glenville Hospital — general hospital — exempt.
Cleveland City Hospital — general hospital — exempt.
Lutheran Hospital — general hospital — exempt.
German Hospital — general hospital — exempt.
Mt. Sinai Hospital — general hospital — exempt.
Canfield, White — general hospital — exempt.
Dalrymple Private Hospital — general hospital — exempt.
Lakewood General Hospital — general hospital — exempt.
St. Alexis Hospital — general hospital — exempt.
St. John's Hospital — general hospital — exempt.
Jewish Infant Orphans' Home — free, exempt.
Babies Dispensary — exempt.
Mrs. Wm. Rosenfelt, 1604 Walnut Avenue — Application withdrawn.
Good Samaritan Hospital — Application withdrawn.
Woodhill Private Hospital — licensed.
Mrs. F. Brachat, 4739 Ravine Street, S. W. — rejected.
Mrs. Agnes Morrill, Cleveland Heights — No action by local board of health.
Mrs. M. E. Huffman — licensed.
Mrs. Grace Mills — licensed.
Mrs. Elizabeth Steinhauer — licensed.
Mrs. Michael McDonald, 7416 Lorain Ave. — Application withdrawn.
Darke County — Children's Home — exempt, free.
Brethren's Home, Greenville — exempt, free.
Defiance County — City Hospital, Defiance — exempt, general hospital.
Children's Home — exempt, free.
Delaware County — Jane M. Case Hospital — exempt, general hospital.
Children's Home — exempt, free.
Erie County — Dr. Carrie Chase Davis, Sandusky — licensed.
Fairfield County — No report from local officers.
Fayette County — Officials report none.
Franklin County — Columbus — St. Anne's Infant Asylum — licensed.
Florence Crittenton Home — licensed.
Mrs. Nora Foster — licensed.
Mrs. Nora Cook — rejected.
Mrs. Zella Briggaman — licensed.
Mrs. Ida M. Malott — rejected.
Dr. F. H. Darby — licensed.
Celia P. Fyler — licensed.
Mrs. Margaret Conklin — licensed — (Clinton Township).
Mrs. Mary E. Throp — licensed — (Clinton Township).
Mrs. E. C. Barker — Declined to apply.
Mrs. Miner — Declined to apply.
Miss E. A. Nichols — Investigation.
Grant Hospital — exempt — general hospital.
Lawrence Hospital — exempt — general hospital.

Mr. and Mrs. Jewell, 387 Oak Street — licensed
Protestant Hospital — exempt — general hospital.
Mercy Hospital — exempt — general hospital.
Mt. Carmel Hospital — exempt — general hospital.
Sixth Avenue Hospital — exempt — general hospital
Franklin County Infirmary — exempt — free.
Mrs. Ann E. Beatty, Linwood Avenue — rejected.
Salvation Cottage — licensed.
Fulton County — Officials report none.
Gallia County — Officials report none.
Geauga County — Officials report none.
Greene County — Dr. McClellan's Hospital — exempt — general hospital.
Guernsey County — Children's Home — exempt — free.
County Infirmary — exempt — free
Hamilton County — Cincinnati — Annie Florein, 640 West 7th Street — rejected.
Annie Powell, 424 W. 4th Street — rejected.
Mrs. Mary Howard, 430 Clark Street — rejected — (later licensed).
Mrs. Nellie Hefferman, 1551 John St. — Died while application was pending
Miss Ida Prickett, 639 West 6th Street — licensed.
Dr. John B. Flock, 900 West 8th Street — not issued.
Home for Friendless and Foundlings — licensed.
The Children's Home — exempt — free.
Ohio Maternity Hospital — licensed.
St. Joseph's Maternity Hospital and Foundlings Asylum — licensed.
Ohio Hospital for Women and Children — general hospital — exempt.
Christ Hospital — general hospital — exempt.
Bethesda Hospital — general hospital — exempt.
Good Samaritan — general hospital — exempt.
Jewish Hospital — general hospital — exempt.
Cincinnati Hospital — general hospital — exempt.
Seton Hospital — general hospital — exempt.
Dr. Elizabeth E. Francis, 817 West 7th St. — rejected.
Medora Bisbee — Investigation.
Mrs. Anna McNairy — licensed.
Salvation Army Maternity Hospital — Application pending
Hancock County — Findlay Home and Hospital — general hospital — exempt.
Bornhill Sanatorium — general hospital — exempt.
Hardin County — No report from local officials.
Harrison County — Officials report none.
Henry County — None.
Highland County — None.
Hocking County — None.
Holmes County — None.
Huron County — The Norwalk Hospital — exempt — general hospital.
County Infirmary — exempt — free.
Mrs. Elliott — Investigation.
Jackson County — Officials report none
Jefferson County — None.
Knox County — No report.
Lake County — City Hospital, Painesville — exempt — general hospital.
Lawrence County — The Carles Gray Deaconess Hospital — general hospital — exempt.
Gray Sanatorium — general hospital — exempt.
Keller Hospital — general hospital — exempt.

Licking County — Newark City Hospital — general hospital — exempt.
  Newark Sanatorium — general hospital — exempt.
  Children's Home — free — exempt.
Logan County — Orphans' Home — free — exempt.
Lorain County — Tyson Sanatorium, Elyria — general hospital — exempt.
  Elyria Memorial Hospital — general hospital — exempt.
  Lakeview Hospital, Lorain — general hospital — exempt.
  Mrs. S. A. Bowers, La Porte — Investigation.
Lucas County — Toledo — Robinwood Hospital — general hospital — exempt.
  Toledo Hospital — general hospital — exempt.
  St. Vincent's Hospital — general hospital — exempt.
  St. Anthony's Hospital — general hospital — exempt.
  Deaconess Hospital — general hospital — exempt.
  Dr. Bett's Hospital — general hospital — exempt.
  Lucas County Infirmary — general hospital — exempt.
  Toledo Girls' Home — Does not take cases.
  Maternity and Foundlings Home — licensed.
  Flower Home for Girls — Does not take cases.
  Mrs. Marie Bretsch — rejected.
  Mrs. McManus, 920 Huron Street — Declined to apply.
  Libbie Thompson — Investigation.
  Mrs. Losette — Investigation.
  Mrs. Myers, 712 Fernwood Avenue — Investigation.
  Mrs. L. M. Sherman — Application pending.
Madison County — Children's Home — free — exempt.
Mahoning County — Youngstown City Hospital — general hospital — exempt.
  Mahoning Valley Hospital — general hospital — exempt.
  County Infirmary — free — exempt.
  Irene Jewell — licensed.
  Dr. W. J. Richie — Investigation.
  Crittenton Home — licensed.
  Mrs. Mary Gray — Investigation.
  C. H. Glenwood — Investigation.
  Mrs. Shunn — Investigation.
Medina County — Officials report none.
Meigs County — Officials report none.
Mercer County — Officials report none.
Miami County — Mrs. Kate Gordon — Application pending.
Monroe County — None
Montgomery County — The Moria Sanitarium, Dayton — general hospital — exempt.
  Miami Valley Hospital, Dayton — general hospital — exempt.
  St. Elizabeth's Hospital, Dayton — general hospital — exempt.
  The Door of Hope Society, Dayton — free — exempt.
  Holliday Children's Home, Dayton — free — exempt.
Morgan County — None.
Morrow County — None.
Muskingum County — Good Samaritan Hospital, Zanesville — general hospital — exempt.
  Bethesda Hospital, Zanesville — general hospital — exempt.
Noble County — None.
Ottawa County — Dr. H. J. Poole Hospital — regular hospital — exempt.
Paulding County — None.
Perry County — None.
Pickaway County — Children's Home — exempt.

Pike County — Children's Home — exempt.
Portage County — None.
Preble County — Children's Home — exempt.
    Mrs. W. A. Robbins, W. Alexandria — Investigation.
Putnam County — Officials report none.
Richland County — Children's Home — free — exempt
    County Infirmary — free — exempt.
Ross County — Chillicothe Hospital — general hospital — exempt.
    Mrs. S. A. Butler, Springfield Tp. — Removed while application was pending
Sandusky County — City Hospital, Fremont — regular hospital — exempt.
    Dr. M. Stramm's Hospital — regular hospital — exempt.
Scioto County — Hempstead Hospital, Portsmouth — regular hospital — exempt.
    Park Hospital, Portsmouth — regular hospital — exempt.
Seneca County — Dr. Wm. Leonard's Hospital, Fostoria — regular hospital — exempt.
    Dr. Gooding's Hospital, Tiffin — regular hospital — exempt.
    St. Francis Orphan Asylum, Tiffin — free — exempt.
    Jr. O. U. A. M. Orphans' Home, Tiffin — free — exempt.
    Ebenezer Orphans' Home, Flat Rock — free — exempt.
Shelby County — Children's Home — free — exempt.
Stark County — Mercy Hospital, Canton — regular hospital — exempt.
    Aultman Hospital, Canton — regular hospital — exempt.
    Ingleside Hospital, Canton — regular hospital — exempt.
    Alliance City Hospital — regular hospital — exempt.
    Mt. Airy Hospital, Massillon — regular hospital — exempt.
Summit County — Akron City Hospital, Akron — regular hospital — exempt.
    Florence Crittenton Home — closed.
    County Infirmary — free — exempt.
    Mary Day Nursery — exempt.
Trumbull County — Warren City Hospital — regular hospital — exempt.
    Children's Home — free — exempt.
Tuscarawas County — Union Hospital, Canal Dover — regular hospital — exempt.
    Children's Home — free — exempt.
Union County — None.
Van Wert County — None.
Vinton County — None.
Warren County — Children's Home — free — exempt.
Washington County — None.
Wayne County — Wooster City Hospital — regular hospital — free.
    Dr. A. T. Bashford Sanitarium — Application not acted on by local board of health.
Williams County — None.
Wood County — None.
Wyandot County — Upper Sandusky, Smalley and Nau's Sanitarium — regular hospital — exempt.

APPLICATIONS REJECTED, LOCAL BOARD OF HEALTH DECLINED TO APPROVE.

Dr. Annie Florein, 640 West Seventh Street, Cincinnati, Ohio
Annie Powell, 421 West Eighth Street, Cincinnati, Ohio
Mary Howard,* 430 Clark Street, Cincinnati, Ohio

Mrs. Nola Pavy, 338 North Front Street, Hamilton, Ohio.
Mrs. Marie Bretsch, 1610 Cherry Street, Toledo, Ohio.
Dr. Elizabeth Francis, 817 West Seventh Street, Cincinnati, Ohio.
Dr. C. Baker, 10405 Marlowe Avenue, Cleveland, Ohio.
Mrs. Nora Cook, 236 East Spring Street, Columbus, Ohio.
Mrs. Ann E. Beatty, 743 Linwood Avenue, Columbus, Ohio.
Mrs. Fredericka Brachat, 4739 Ravine Street, Cleveland, Ohio.
Mrs. M. Malott, 287 West Park Avenue, Columbus, Ohio.

APPLICATIONS PENDING, AWAITING ACTION BY LOCAL BOARD OF HEALTH.

Mrs. Agnes Morrill, 14314 Superior Street, Cleveland Heights, Ohio.
Dr. A. T. Bashford, Wooster, Ohio.
Mrs. S. A. Butler, Springfield Tp., Ross County, Chillicothe, Ohio.
Mrs. Ella Hastings, 928 Miller Avenue, Columbus, Ohio.
Mrs. L. M. Bowers, 410 Sherman Street, Toledo, Ohio.

LIST OF LICENSED MATERNITY BOARDING HOUSES AND LYING-IN HOSPITALS.

License Number.	Name and Address.	Number of Births in 1909.	Number of Infants Received, Cared for or Treated.	No. Deaths (Mother).	No. Deaths (Child).	Date of Inspection.	License Expires.	Accommodations at One Time.		Remarks.
								Women.	Children.	
1	St. Joseph's Mat. Hosp. and Foundling Asylum, Cincinnati. (Norwood)	90	115	0	1 s. b. 42	Oct. 1908 June 1909 Dec. 1909	Dec. 22, '09	......	......	License renewed.
2	Ohio Maternity Hospital, 529-33 E. Liberty St., Cincinnati, O..	135	158	3	21	Oct. 1908 Nov. 1909	Dec. 22, '09	......	......	License renewed.
3	Home for the Friendless and Foundlings, W. Court St., Cincinnati	62	115	0	16	Sept. 1908 Oct. 1908 May 1909 Nov. 1909	Dec. 22, '09	......	......	License renewed.
4	Ida Prickett, 639 W. Sixth St., Cincinnati	1	0	0	0	Nov. 1908 May 1909 Aug. 1909 Nov. 1909	....	2	2	License renewed. Lying in hospital.
5	Mrs. J. T. Black, 633 W. Spring St., Lima	2	0	0	1	Dec. 1908	Feb. 4, '10	1	1	Lying-in hospital.
6	Mrs. Mary E. Throp, Jason Ave., Sta. B., Columbus..............	0	29	0	3	Oct. 1908 June 1909 Dec. 1909	Feb. 4, '10	......	11	Maternity boarding house.
7	Mrs. Margaret Conklin, Sta. B., Columbus	0	0	0	0	Oct. 30, 1908	Feb. 4, '10	......	2	Maternity boarding house. Has had no children under 2 years.
8	Dr. F. H. Darby, 31 W. 1st Ave., Columbus	0	0	0	0	Nov. 4, 1908	Feb. 4, '10	......	2	Agent Children's Home Soc. of Ohio. Has had no children under 2 years.
9	St. Anna's Infant Asylum, 1555 Bryden Road, Columbus.......	9	101	0	18	Nov. 1908 Aug. 1909	Feb. 4, '10	5	75	
10	Mrs. Zella Briggaman, 591 Lehman St., Columbus............	0	13	0	1	Aug. 1908 April 1909 May 1909	Feb. 4, '10	......	7	Maternity boarding house.
11	St. Anne's Infant Asylum and Mat. Hosp., 3409 Woodland Ave., Cleveland	362	160	1	6 s. b. 92	Dec. 1908	Feb. 4, '10	......	......	
12	Mrs. Nora Foster, 43 W. Oakland, Columbus	0	0	0	0	Dec. 1908 June 1909	Feb. 4, '10	2	2	Lying in hospital. Has had no cases.

LIST OF LICENSED MATERNITY BOARDING HOUSES AND LYING-IN HOSPITALS.—Concluded.

License Number.	Name and Address.	Number of Births in 1909.	Number of Infants Received, Cared for or Treated.	No. Deaths (Mother).	No. Deaths (Child).	Date of Inspection.	License Expires.	Accommodations at One Time.		Remarks.
								Women.	Children.	
14	Celia P. Fyler, 964 Highland, Columbus	0	1	0	0	Nov. 1908	Feb. 4, '10	......	......	Maternity boarding house.
15	The Retreat Mat. Hospital and Foundlings' Home, 1609 Summit St., Toledo	39	128	0	12	Oct. 1908 March 1909	Feb. 4, '10	15	22	
16	Dr. Carrie Chase Davis, Sandusky, O.	7	7	0	0	Nov. 1908	Feb. 4, '10	5	5	Lying-in hospital.
17	Mrs. A. Eble, 4720 Ravine St. S. W., Cleveland	0	11	0	2	Dec. 1908 June 1909 Dec. 1909	Feb. 26, '10	......	9	Maternity boarding house.
18	Mrs. Leah Martin, 5023 Doloff Rd., Cleveland	0	1	0	1	Dec. 1908 Dec. 1909	Feb. 26, '10	1	2	Maternity boarding house and lying-in hospital.
19	Mrs. Emma Biggs, 6616 Faircourt N. E., Cleveland	0	0	0	0	Dec. 2, 1908	Feb. 26, '10	......	2	Has had no children.
20	Mrs. Minnie Knapp, 2419 W. 11th St., Cleveland	0	16	0	1	Jan. 6, 1909 Dec. 2, 1909	Feb. 26, '10	......	6	Boards children for Juvenile Court.
21	Mrs. Annette Chase, 3119 Marvin Ave., Cleveland	0	0	0	0	Dec. 1908 Dec. 1909	Feb. 26, '10	......	15	Retired in Dec. 1909. Conducts boarding school for older children. None under 2 years.
22	Mrs. Ida Dewey, 7804 Kinsman Road, Cleveland	0	10	0	0	Dec. 1908 Dec. 1909	Feb. 26, '10	......	4	Maternity boarding house.
24	Woodhill Private Hospital, 3192 E. 93rd St., Cleveland	2	0	0	1	Dec. 29, 1908	Feb. 26, '10	7	7	Lying-in hospital
25	Salvation Army Mat. Hosp., 5905 Kinsman Road, Cleveland	29	108	0	12	Dec. 8, 1908	Feb. 26, '10	7	15	
26	Maternity Hospital of Cleveland, 2364 E. 55th St.	163	122	2	10 s. b. 2 a. b. 1 p. b.	Dec. 8, 1908	Feb. 26, '10	21	15	
27	Cleveland Humane Society (Infants' Rest)	0	75	0	2	Dec. 9, 1908	Feb. 26, '10	......	15	
*28	Mrs. Mary Howard, 1130 Clark St., Cincinnati	11	11	0	2	Sept. 1908 Oct. Dec. Feb. May July Nov. 1909	Mch. 5, '10	5	5	Lying in hospital.

29	Mrs. Margaret Snyder, 276 W. Woodruff, Columbus	0	0	0	0	April 1, 1909	Apr. 14, '10	......	3	Decided not to engage after license was granted.
30	Mrs. R. Jewell, 387 Oak St., Columbus	2	0	0	1	March 1909 April 1909 Dec. 1909	Apr. 14, '10	2	2	
31	Mrs. Irene Jewell, 74 St. Louis Ave., Youngstown, O..........	0	0	0	0		....	......	......	Removed from State. Lying in Hospital.
32	Florence Crittenton Home, Columbus, O.	15	31	0	1 s. b. 3	Feb. 1909 May 1909	June 7, '10.	5	5	
33	Florence Crittenton Home, Youngstown, O.	5	19	0	2		June 23, '10	10	10	
34	"Salvation Cottage", 74 N. Harris Ave., Evangeline Reams, Columbus, O.	4	4	0	0	June 21, 1909	Sept. 9, '10	6	6	Obstetrical cases delivered at Protestant Hospital Also conducts a "Rescue Home."
35	Mrs. M. E. Huffman, 3142 W. 70th, Cleveland	0	7	0	0	June 1909	Sep. 22, '10	......	6	Maternity boarding house.
36	Mrs. Grace Mills, 1230 E. 80th St., Cleveland	0	21	0	4	Oct. 4 Dec. 1, 1909	Dec. 3, '10	......	16	Maternity boarding house.
37	Mrs. A. L. McNairy, 322 W. 4th St., Cincinnati	0	0	0	0	Nov. 1909	Dec. 3, '10	2	2	Lying-in hospital.
38	Mrs. Eliz. Steinhauer, 2083 W. 26th, Cleveland	0	0	0	0	Dec. 1, 1909	Dec. 23, '10	1	6	
	Totals	938	1,602	9	257					

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* 1st application rejected. Later reconsidered and recommended by local board of health.

APPLICATION.

...., Ohio, ... 19...

To the Ohio State Board of Health,
Columbus, Ohio.

Gentlemen: —

The undersigned respectfully makes application for license to conduct a Maternity Boarding House or Lying-in Hospital at number ...., ... Street, ... City, Village, Township.......................................County, State of Ohio. Such application is made under the provisions of an act "To regulate the establishment, maintenance and inspection of maternity boarding houses and lying-in hospitals," passed February 17, 1908. (O. L., V. 99, p. 13.)

....
Signature of applicant.

Received by the Ohio State Board of Health:

....

OHIO STATE BOARD OF HEALTH.

INSPECTION OF MATERNITY BOARDING HOUSES AND LYING-IN HOSPITALS.

NOTICE OF ADMISSION.

.... Ohio, ... 19...

To the Board of Health,
...................................., Ohio.

Sirs:—

I desire to notify you of the admission of the following person:

Name in full of person admitted ....

Home address of person admitted ....
Town. Street and Number.

Age: Years............ Months............ Days............ Sex............

Color............ If a child, give name of mother and her address including town, street and number ....

Date of admission .... 19...

Signed ...., Proprietor.

License No .... License expires .... 19...

Residence ....
Street and Number.

Note: — Send one copy of this blank to the Ohio State Board of Health, Columbus, Ohio, within twenty-four (24) hours after the admission of each woman or child. Send a copy of this blank to the board of health of the city, village or township in which your maternity boarding house or lying-in hospital is located within twenty-four (24) hours after the admission of each woman or child.

OHIO STATE BOARD OF HEALTH.

INSPECTION OF MATERNITY BOARDING HOUSES AND LYING-IN HOSPITALS.

NOTICE OF BIRTH.

...................................., Ohio, ... 19...

To the Board of Health,

...................................., Ohio.

Sirs:—

I desire to notify you of the birth of a male, female child to ....

...., who was admitted to my institution

Name of Mother.

on the .... day of ...., 19... Dr. ....

of .... Street, ...

city or village, State of Ohio, was in attendance at this birth.

License No. .... Signed ....,

Proprietor.

License expires ...., 19... Address ....

Street and Number.

Note: — Send one copy of these blanks, properly filled out, to the Ohio State Board of Health, Columbus, Ohio, within twenty-four (24) hours after the birth of each child. Send a copy of this blank to the board of health of the city, village or township in which your maternity boarding house and lying-in hospital is located within twenty-four (24) hours after the birth of each child.

OHIO STATE BOARD OF HEALTH.

INSPECTION OF MATERNITY BOARDING HOUSES AND LYING-IN HOSPITALS.

BLANK TO BE USED WHEN WOMAN IS DISCHARGED.

...................................., Ohio, ... 19...

To the Board of Health,

...................................., Ohio.

Sirs:—

I desire to notify you of the discharge of ....,

Name of Woman.

who was admitted to my institution on .... day of ...., 19...

Her child, born on .... day of ...., 19..., accompanied her.

(If other disposition of child was made, so state).............................

....

Signed .... Proprietor.

License No. .... License expires ...., 190...

Address ....

Street and Number.

NOTE:—Send one copy of this blank, properly filled out, to the State Board of Health, Columbus, Ohio, within twenty-four (21) hours after the discharge of each woman. Send a copy to the board of health of the city, village or township in which your maternity boarding house or lying-in hospital is located within twenty-four (24) hours after the discharge of each woman.

OHIO STATE BOARD OF HEALTH.

INSPECTION OF MATERNITY BOARDING HOUSES AND LYING-IN HOSPITALS.

NOTIFICATION OF ADOPTION, TAKING AWAY OR GIVING OUT OF CHILD.

.................................., Ohio, ... 19

To the Board of Health,

.................................., Ohio.

Sirs:—

The following is respectfully reported:

Name of child in full ....

Sex ...., Color ...., Date of birth.................... Month Day Year

Full name of mother ....

Home address ....

Was child adopted?............ Taken away?............ Given out?.........

Name of person or persons adopting or taking away child.......................

....

Residence of such person or persons ....

....

If adopted, give name of charitable organization, society, organization or institution incorporated under the laws of Ohio, or Juvenile Court, giving consent thereto ....

....

License No. .... Signed ...., Proprietor

License expires ...., 19... Address .... Street and Number.

NOTE:—Send one copy of this blank, properly filled out, to the Ohio State Board of Health, Columbus, Ohio, within twenty-four hours after any child is given out or taken away. Mail a second copy to the board of health of the city, village or township in which said maternity boarding house and lying-in hospital is located within twenty-four hours after any child is given out or taken away.

OHIO STATE BOARD OF HEALTH.

INSPECTION OF MATERNITY BOARDING HOUSES AND LYING-IN HOSPITALS.

NOTICE OF DEATH.

...., Ohio, ... 19..

To the Board of Health,

.................................., Ohio.

Sirs:—

I desire to notify you of the death of ....
........................, an inmate of my maternity boarding house and lying-in hospital. Deceased was a (woman, child); aged .... years .... months .... days. Death occurred on .... day of .... 19... at .... o'clock... M. Dr. .... of .... Street, ... was the attending physician.

Signed ....
Proprietor

Address ....
Street and Number.

License Number .... License expires ...., 19...

NOTE: — Send a copy of this blank, properly filled out, *immediately* after the death of each woman or child to the State Board of Health, Columbus, Ohio; and a second copy to the board of health of the city, village or township in which your maternity boarding house or lying-in hospital is located.

PAGE FROM REGISTER REQUIRED TO BE KEPT BY EACH LICENSED PROPRIETOR

Full name of person admitted ....

If a child give name and address of mother ....

Date of admission ....

Home address ....

Age, ... years, ... months, ... days.

Color ....; Sex ....

Date of birth of child ....
month day year

Name of attending physician ....

Address of attending physician ....

What illness has infant suffered from while in your care?..........

....

Name of physician attending infant during illness, Dr. ....

.... Address ....

Was child born on premises?..........

Was child brought to you after birth?..........

Was child adopted?......., given out? ...., taken away?.......

Name of person or persons adopting or taking away child..........

....

Name of person or persons adopting or taking away child..........

....

Give name of a charitable organization, society, organization or institution incorporated under the laws of Ohio, or Juvenile Court, giving consent to the adoption of this child..........

....

Date of taking away, adoption or giving out of child..........

Give exact date of discharge of mother from your institution, ... month, ... day, ... year.

Give exact date of discharge of child from your institution, ... month, ... day, ... year.

Did child leave your institution with mother?..........

In case of death of mother or child, the following additional information is required:

Name of deceased in full..........

If a child, name of mother ....

Sex ......, color ......, age .... years, ... months, ... days

Name of attending physician ....

Address of attending physician ....

Give date and hour of death:

Month ...., day ...., year ...., at .... o'clock, A. M.—P. M.

Cause of death ....

Was the Ohio State Board of Health and local board of health notified within twenty-four hours after the admission of this woman or child? ....

Give date of such notification ....

Was Ohio State Board of Health and local board of health notified within twenty-four hours after adoption, giving out or taking away of this child?..........

Give date of such notification ....

Was Ohio State Board of Health and local board of health *immediately* notified of the death of this woman or child? ......

Give date of such notification ....

Remarks ....

....

Signed ...., Proprietor.

REPORT OF LABORATORY WORK

For Year Ending December 31, 1909.

REPORT OF CHIEF OF LABORATORIES.

I have the honor to present the following report for the year ending December 31st, 1909.

In laboratories such as are maintained by the State Board of Health where much work of varied character is performed, it is essential for successful operation, 1st, that the work be absolutely accurate, 2nd, that it be performed as rapidly as possible, and 3rd, that reports, particularly bacterial diagnoses for physicians be sent out in the least time possible consistent with careful work.

The technique, methods and systems inaugurated when the laboratories were established were sufficient for the occasion, but with the widening of the scope and the continual increase in the amount of work they gradually became entirely inadequate, resulting in a complete

REORGANIZING AND SYSTEMATIZING

during the present year. This has taken much valuable time, but the result has proved very satisfactory.

Accuracy.

Competent technical men will, for the sake of their reputations, carefully check their analyses and computations. Much depends, however, on the way the original records are kept, not only from the greater liability to error in figures set down in a haphazard manner, but from the standpoint of future reference. What may be perfectly clear at the time figures are set down, may be meaningless two years from now unless the notes are carefully and orderly made. To this end printed books have been substituted for blank books for the regular routine analyses, all analyses of one kind being grouped and arranged in numerical sequence.

Records.

For a permanent record of water and sewage analyses, a card system has been established. While the analyses are in process these cards indicate the extent of progress on samples. When the analysis is complete, they form a permanent record, and are filed by towns.

For Diagnostic Records.

In place of the former information blank folder, which had to be twice copied, a card has been substituted, the permanent record of each case thus being in the physician's handwriting.

Reporting.

Greater speed in reporting results of bacterial diagnoses has been secured in the case of diphtheria by the establishment of swabs and five hour incubation examinations. All bacterial reports are now made direct from the laboratory, and a daily sheet giving the results of all bacterial examinations is placed on file in the main office of the Board.

CHANGE IN NAME OF LABORATORIES.

As the work of this department is at present separated into three distinct lines of work with the promise of greater diversity in the future, the official name of the laboratories has been changed to the Hygienic Laboratories of the Ohio State Board of Health.

NEW FORMS OF BACTERIOLOGICAL OUTFITS.

New forms of diphtheria, typhoid and sputum outfits have been devised and distributed to the outfit stations.

The diphtheria outfit is lighter and therefore costs less to express or mail. It is so constructed that serum can also be included in the outfit if this is found to be advantageous. Wooden swabs have replaced the aluminum type, being more convenient to handle, cheaper, more easily disposed of and more satisfactory in every way.

The larger bottle in the new sputum outfit allows for a more generous specimen, while the presence of carbolic acid in the bottle insures the receipt of the specimen in good condition and is also lighter than the old one.

The new typhoid outfit is contained in a stout manila envelope and requires but sealing and stamping to make it ready for the mails; while the specimen is submitted in much more satisfactory shape for examination.

CONDITION OF THE LABORATORIES.

During the year, a new 37° incubator, a new microtome, a new microscope, new animal cages, etc., have been added to the equipment of the laboratories, besides necessary filing cases, etc., in the office. The laboratories are now crowded almost beyond endurance and unless some relief can be afforded, this is sure to result in conditions antagonistic to careful work. A ventilating fan was installed during the year, but the air in the laboratories is still very poor. No great addition to the old lines of work or any new work can be undertaken until more space is secured. An animal room necessary for part of the rabies work has been installed in the light shaft of the bacteriological laboratory. The small amount of reflected daylight secured renders it impossible to conduct much microscopical work.

RESEARCH AND INVESTIGATIVE WORK.

The large amount of time necessitated in the work of reorganization has prevented any extended research work. The following, however, has been accomplished:

"An Investigation of the Efficiency of the Dayton Electrolytic Cell in the Disinfection of Water and Sewage." (B. R. Rickards and C. F. Long, Bulletin, Ohio State Board of Health, October, 1909.)

"Collaboration with the Committees of the Laboratory Section of the American Public Health Association on Standard Methods for the Bacterial Diagnosis of Diphtheria" and "Standard Methods for the Chemical Examination of Water and Sewage." In the former case considerable work has been done on the question of whether it is essential to inoculate serum or not, at the time of taking the swab and on the question of types of bacilli to be considered positive for diagnosis and release.

The former question is of the greatest importance to State laboratories as at present very few laboratories send out serum on account of its liability to become broken, contaminated or dry. These difficulties can, of course, be overcome to a great extent if experiments show that the best results are obtained by inoculating serum at the bedside. At present conflicting results have been obtained by different members of the committee and further work along this line is indicated.

In addition to the above, the writer, at the suggestion of the Secretary, has paid considerable attention to obtaining facts and figures relative to the cost of manufacturing and distributing diphtheria antitoxin and anti-rabic virus.

From the information obtained it is evident that the great benefits of antitoxin can be extended to all at a reasonable figure, and that the cost to the state can be reduced after the first cost of installation is paid. With anti-rabic virus the reduction in cost to the State would be in the neighborhood of $20,000.00. From an economical standpoint alone, the State should undertake this work which falls logically under the work of the State Board of Health. Several states have already undertaken this work.

OUTFIT STATIONS.

During the year the number of stations in the state for the distribution of our diphtheria, typhoid and tuberculosis outfits has been increased from about 95 to about 255. It is the ultimate intention to have at least four stations to a county, conveniently situated geographically, so that physicians throughout the State may take advantage of the facilities of the laboratories. In so far as possible those stores carrying State label antitoxin have been given the preference in establishing outfit stations and vice versa, since there is undoubtedly considerable advantage to the physician in having both together. For the most part these stations are located in drug stores, but in some cases where no satisfactory pharmacy could be found, general stores have been selected, or the health officer or some physician has consented to so act. Following is a list of the antitoxin and outfit stations.

LIST OF DISTRIBUTORS OF DIPHTHERIA, TUBERCULOSIS AND TYPHOID OUTFITS AND OF STATE LABEL ANTITOXIN IN THE STATE OF OHIO.

ADAMS COUNTY:

*W. W. Alexander, Manchester.
*Chas. L. Perry, Peebles.
*Dr. Jas. W. Bunn, West Union.
*W. E. Sexton, Winchester.

ALLEN COUNTY:

*A. Hauenstein & Son, Bluffton.
*King & Williams, Delphos.
*William Melville, Lima.
*J. M. Beard, Spencerville.

ASHLAND COUNTY:

†W. B. Cousins, Ashland.
*K. G. Ayres, Perrysville.
*R. N. Shaw, Savannah.

ASHTABULA COUNTY:

†Knowlton & Allen, Ashtabula.
*J. H. Hipple, Andover.
*Conneaut Drug Co., Conneaut.
*F. J. Hoffner, Geneva.
*John Jones Pharmacy, Jefferson.

ATHENS COUNTY:

*F. W. Gibson, Amesville.
*J. Halliday Cline, Athens.
*Taylor & Son, Coolville.
*Gem Pharmacy, Nelsonville.

AUGLAIZE COUNTY:

*Geo. W. Higgins, St. Marys.
*William Kayser, Wapakoneta.
*Chas. Fasig, Waynesfield.

BELMONT COUNTY:

†Hilles-Hutton Drug Co., Barnesville.
*Kane's Pharmacy, Bellaire.
*Selby & Reed, Martins Ferry.
*J. D. Crossland, St. Clairsville.
†Bowie & Co., Bridgeport.
*Dr. G. L. Ramsey, Powhatan Point.

BROWN COUNTY:

*S. J. Fitzpatrick, Fayetteville.
†W. H. Hannah, Georgetown.
*The Maddox Drug Co., Ripley.

BUTLER COUNTY:

*Radcliffe Drug Co., Hamilton.
*Jno. T. Fay, Middletown.
§G. M. Adams, Oxford.

CARROLL COUNTY:

*J. H. McElroy, Carrollton.
*Ross & Son, Malvern.
*B. S. Andrews, Mechanicstown.
*R. O. Moore, Leesville.

CHAMPAIGN COUNTY:

†Chas. F. Downey, Urbana.
*A. Musselman Drug Co., St. Paris.

CLARK COUNTY:

§T. J. Miranda, New Carlisle.

CLERMONT COUNTY:

*A. C. Nash, Batavia.
*J. W. Kennedy & Son, Felicity.
*B. C. Reber, Loveland.
*J. W. Moss, New Richmond.

CLINTON COUNTY:

*Sabina Drug Co., Sabina.
*Brown's Drug Store, Wilmington.
§H. L. Day, Blanchester.

COLUMBIANA COUNTY:

*Chas. F. Craig, East Liverpool.
*Ourant & Sutherin, East Palestine.
*H. V. George, Lisbon.
*Fred T. Bennett, Salem.
*C. N. Brannon, Wellsville.

COSHOCTON COUNTY:

*W. H. Leavengood, Fresno.
†W. M. Smith, Coshocton.

CRAWFORD COUNTY:

*R. T. Johnston & Son, Bucyrus.
*A. H. Kinsey, Crestline.
†Dr. H. H. Hartman, Galion.
*C. E. Hildebrand, New Washington.

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†Carries outfits only.
§Carries antitoxin only.

CUYAHOGA COUNTY:
- *Robert Forbes, Bedford.
- *Dr. D. T. Gould, Berea.
- *Dr. J. S. Wood, Collinwood.
- †Dole Drug Co., Lakewood.

DARKE COUNTY:
- *B. F. Carter Co., Arcanum.
- †Wm. Kipps Sons, Greenville.
- †Ohio Drug Store, Union City, Ind.
- §Ralf. Goodall, Versailles.

DEFIANCE COUNTY:
- *A. M. Minsel, Defiance.
- *V. G. Ripley & Son, Hicksville.
- §Golier & Kintner, Ney.

DELAWARE COUNTY:
- *N. U. Starr, Delaware.
- *E. I. Jones, Radnor.
- *R. P. Anderson, Sunbury.

ERIE COUNTY:
- *Garrett Son & Woessner, Huron.
- *Wm. F. Burger, Kellys Island.
- *C. H. Nuhn, Vermillion.
- *Lewis H. Ohly, Sandusky.

FAIRFIELD COUNTY:
- †Geo. H. Wetzel, Lancaster.
- §J. A. Kumler, Baltimore.
- *L. S. Bennett, Lithopolis.

FAYETTE COUNTY:
- *Blackmer & Tanguay, Washington C. H.

FRANKLIN COUNTY:
- *W. R. Smith, Groveport.
- *Dr. A. H. Keefer, Westerville.

FULTON COUNTY:
- *H. C. King Co., Fayette.
- *Fink & Haumesser, Wauseon.
- *B. F. Mills, Swanton.

GALLIA COUNTY:
- *E. L. Neal, Gallipolis.
- *J. H. Feltman, Vinton.

GEAUGA COUNTY:
- *Paul R. Sanders, Chagrin Falls.
- *A. J. Cromwell, Chardon.
- *F. P. Johnson, Middlefield.

GREENE COUNTY:
- *W. F. Harper, Jamestown.
- *Copsey & Britton, Spring Valley.
- †Sayre & Hemphill, Xenia.

GUERNSEY COUNTY:
- *J. A. Warfield, Washington.
- *A. Ledler & Son, Kimbolton.
- †Brooks Sutton, Cambridge.

HAMILTON COUNTY:
- *F. Schanzle, Elmwood Place.
- *A. C. Adler, Reading.
- †Leo Dressel, Norwood.

HANCOCK COUNTY:
- *Julien & Davis, Arlington.
- *W. B. Newton, Findlay.
- *Henney & Cooper, McComb.
- §G. W. Campbell, Alger.

HARDIN COUNTY:
- *Conner Bros., Ada.
- *S. A. Hagerman, Dunkirk.
- †M. G. Furney & Son, Kenton.

HARRISON COUNTY:
- *W. L. Sharp & Co., Cadiz.
- *Howell & Starkey, Freeport.
- *Custer Drug Co., Scio.

HENRY COUNTY:
- *J. L. Sherman, Holgate.
- *Morey & Meyer, Napoleon.
- §Wm. Nelson, McClure.

HIGHLAND COUNTY:
- *H. Christopher, Greenfield.
- †Garrett & Ayres, Hillsboro.
- *M. A. Williams, Leesburg.

HOCKING COUNTY:
- †Bort & Co., Logan.
- *Geo. Gill, South Bloomingville.
- §Dr. T. J. Dillinger, Murray.

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HOLMES COUNTY:

†Drs. Stucky & Dornblaser, Walnut Creek.
*H. J. Handenschild, Loudenville.
†Strome & Son, Millersburg.

HURON COUNTY:

*D. O. Williams, Chicago Junction.
*Otto M. Harter, Norwalk.
*F. H. Nickerson, Greenwich
§J. H. Brinker, Bellevue.

JACKSON COUNTY:

*H. B. Shaffer, Jackson.
*D. S. Jenkins, Oak Hill.
*Kelley Bros., Wellston.

JEFFERSON COUNTY:

*S. A. Carson, Bergholz.
*Dr. C. W. Mercer, Dillonvale.
*Ridgley's Drug Store, Steubenville.
§B. J. Fogle, Toronto.

KNOX COUNTY:

*Burris & Shaw, Danville.
*Carl N. Lorey, Mt. Vernon.
†Chas. F. Fink, Fredericktown.
§C. V. Horn, Bladensburg.

LAKE COUNTY:

*L. C. Phelps, Madison.
†Fred J. Barnes, Painesville.
*Fickes Phar., Willoughby.

LAWRENCE COUNTY:

*Ball & Warfield Co., Ironton.
*Dr. R. E. Atkinson, Proctorville.

LICKING COUNTY:

*Frank S. Paige, Johnstown.
†W. A. Erman & Son, Newark.
*Dr. G. T. Ely, Utica.
§Geo. W. Hortman, Pataskala.

LOGAN COUNTY:

*R. H. Valentine, Belle Center.
†G. M. Frazer, Bellefontaine.
*R. S. Wheeler, West Liberty.
*J. L. Hoffman, West Mansfield.

LORAIN COUNTY:

*E. C. Hague, Elyria.
*Wm. Honecker, Lorain.
*Frank W. Tobin, Oberlin
*E. W. Adams, Wellington.

LUCAS COUNTY:

*L. A. Eckert, Maumee.
*V. H. Adams, Sylvania.
†Jos. A Wernert, Toledo

MADISON COUNTY:

*J. R. Atchison, London.
*A. J. Tannehill, Mt. Sterling.
*Bonner & Balthaser, Plain City

MAHONING COUNTY:

*E. D. Lynn, Canfield.
†J. M. Hazen, Sebring.
*Lyons-Laeri Co., Youngstown

MARION COUNTY:

*C. E. Kelley, Caledonia.
*Sifritt's Pharmacy, LaRue.
†M. L. Dumble, Marion.

MEDINA COUNTY:

*Rowland Bros., Lodi.
*W. J. Wall, Medina.
*A. D. Blough, Wadsworth.

MEIGS COUNTY:

*Drs. Philson & Philson, Racine
*Harvey's Pharmacy, Pomeroy.
§B. S. Barrett, Rutland.

MERCER COUNTY:

†R. E. Riley Drug Co., Celina.
*C. N. Mallory & Son, Rockford.
*S. J. Samburg, St. Henry.
§J. F. Adams, Ft. Recovery.

MIAMI COUNTY:

†T. A. Warley & Son, Covington
*P. I. Hedges, Piqua.
*Jno. M. Fulkerson, Troy.
§B. J. Ford, West Milton.

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MONROE COUNTY:

*R. W. Pope, Woodsfield.
*Kathryn Kelly, Clarington.

MONTGOMERY COUNTY:

*Spitler & Spitler, Brookville.
†H. G. Carnell, Dayton.
*D. E. Heisey, Farmersville.

MORGAN COUNTY:

*C. S. Gibson, McConnellsville.
*T. J. Lyne, Stockport.

MORROW COUNTY:

*F. D. Phillips, Marengo.
†H. G. Peters, Mt. Gilead.

MUSKINGUM COUNTY:

*J. W. Garrett, Adamsville.
*J. M. Given Co., Chandlersville.
†Widney's Drug Store, Zanesville.

NOBLE COUNTY:

§J. T. Dew & Son, Summerfield.
*W. H. Bowron, Caldwell.
§C. F. Atkinson, Dexter City.

OTTAWA COUNTY:

*F. J. Schimansky, Oak Harbor.
*A. L. Green, Port Clinton.
*Johannsen & Schnoor, Put-in-Bay.

PAULDING COUNTY:

†W. C. Pate, Antwerp.
†H. G. Remage, Paulding.

PERRY COUNTY:

*S. R. Souders, Crooksville.
*Dr. Geo. L. Saunders, Corning.
*Bailey & Finck, Somerset.
†Sheeran Drug Co., New Lexington.
§Blaire's Phar., Shawnee.

PICKAWAY COUNTY:

*J. G. Wilder, Circleville.
*New Holland Drug Co., New Holland.

PIKE COUNTY:

†E. T. Tetrick, Waverly.
§Head & Baker, Cynthiana.

PORTAGE COUNTY:

§L. S. Nicholson, Nelson.
*Hale Thompson, Kent.
*O. S. Steinbrueck, Mantua.
*R. Sibson, Diamond.
†F. F. Mott, Garrettsville.
§Lyon & Morgan, Ravenna.

PREBLE COUNTY:

*J. H. L. Bohn, Camden.
*C. B. Cokefair, Eaton.
†L. B. Foos, West Manchester.

PUTNAM COUNTY:

*Hickman Bros., Leipsic.
*Gerding & Co., Ottawa.
§H. M. Agner, Continental.

RICHLAND COUNTY:

†C. F. Sattler, Belleville.
†Lucas Bros., Mansfield.
*Ihrig Pharmacy, Shelby.

ROSS COUNTY:

*R. Wissler, Chillicothe.
*A. W. Teter, Bainbridge.
*Hughey's Drug Store, Frankfort.

SANDUSKY COUNTY:

*H. B. Tiffany, Clyde.
†Thomas & Grund, Fremont.
*E. A. Williams Co., Gibsonburg.

SCIOTO COUNTY:

*Flood & Blake, Portsmouth.
*Ferrt & McCurdy, Wheelersburg.

SENECA COUNTY:

*R. T. Hearson, Attica.
*Campbell & Sons, Fostoria.
*J. T. Campbell & Co., Tiffin.

SHELBY COUNTY:

*A. Weller, Anna.
*F. D. Christian, Sidney.
*Will H. Quinlin, Loramie.

STARK COUNTY:

*Cassaday Drug Co., Alliance.
†L. H. Koch, Canton.
†E. S. Craig, Massillon.
*T. D. Cross, Minerva.

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SUMMIT COUNTY:

*Wm. Dutt, Akron.
*W. J. Stimson, Barberton.
*Dr Geo. A. Miller, Hudson.

TRUMBULL COUNTY:

*Ward's Pharmacy, Niles.
*Byard & Voit, Warren.
*Wallace-Davis Co., Kinsman.
*West Farmington Drug Co., W. Farmington.

TUSCARAWAS COUNTY:

*F. E. LePage, Canal Dover.
*Geo. A. Beer & Co., New Comerstown.
*Opes & March Co., New Philadelphia.
*J. W. White Drug Co., Uhrichsville.

UNION COUNTY:

*Wolgamot Bros., Marysville.
*W. C. Wolmagot, Richwood.

VAN WERT COUNTY:

*J. W. Swoeland, Ohio City.
*Webster Bros., Van Wert.

VINTON COUNTY:

*L. Pearce, McArthur.
†Dr. A. A. Boal, Zaleski.

WARREN COUNTY:

*M. W. Earhart, Franklin.
*W. H. Jackson, Lebanon.
*Mount's Drug Store, Morrow.
†F. C. Swartz, Waynesville.

WASHINGTON COUNTY:

†A. J. Richards, Marietta.
*Dr. W. L. West, New Matamoras.
*B. L. Stone Belpre.

WAYNE COUNTY:

*Dreibelbis & Co., West Salem.
*S. H. Boyd & Co., Wooster.
§T. E. Rice, Orrville.
*Dr. W. A. Winkler, Apple Creek.

WILLIAMS COUNTY:

†A. C. Steckel, Bryan.
*W. H. Chilcote & Daughter, Edgerton.
*Loudon Bros., Montpelier.

WOOD COUNTY:

*Starn & Russell, Bowling Green.
*Chas. A. Fehr, Pemberville.
*E. A. Saxby, Weston.
†Clark Patton, Grand Rapids.

WYANDOT COUNTY:

*M. A. Washborn, Carey.
*H. H. Balliet, Sycamore.
†Tschanen Bros., Upper Sandusky.

EXAMINATIONS.

The total number of examinations for the year was 4.585 divided as follows:

Bacterial diagnoses (including also rabies)	2.630
Sanitary water analyses	1.291
Sewage and trade wastes	416
Special examinations	245
	4,585

The total increase in the amount of work over last year is 1,653 or 56 per cent.

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TABLE CLASSIFYING AND SUMMARIZING EXAMINATIONS FOR THE YEAR 1909.

	Diphtheria.	Tuberculosis.	Typhoid.	Rabies.	Miscellaneous.	Water Analyses.	Sewages and Wastes.	Total.
January	22	118	10	3	4	84	46	287
February	28	84	15	16	3	153	38	337
March	20	149	27	7	8	100	13	324
April	49	123	21	7	0	106	9	315
May	17	129	11	17	4	111	14	303
June	13	102	27	21	3	54	23	243
July	14	122	47	14	1	109	16	323
August	25	126	134	19	41	168	17	530
September	43	123	190	12	156	178	32	734
October	65	119	76	12	3	95	149	519
November	55	136	61	7	1	65	53	378
December	43	103	40	8	21	71	6	292
	394	1,434	659	143	245	1,294	416	4,585

DIPHTHERIA.

TABLE SHOWING NUMBER OF EXAMINATIONS CLASSIFIED.

	Positive.	Negative.	Atypical.	Unsatisfactory.	Total.
January	3	19	0	0	22
February	5	23	0	0	28
March	3	17	0	0	20
April	7	32	0	10	49
May	6	11	0	0	17
June	1	12	0	0	13
July	5	9	0	0	14
August	3	19	1	2	25
September	23	17	0	2	42
October	28	37	0	0	65
November	26	26	0	3	55
December	16	26	1	0	43
	126	249	2	17	394

32%

The total number of diphtheria examinations is increased by two over the total for 1908. As there were 133 special cultures made in 1908 by the laboratory at the Girls' Industrial School at Delaware, and but 35 special cultures during 1909 (at the Children's Home at Zanesville) there is an actual increase in the number of diphtheria examinations for 1909 of 100 routine examinations.

The total percentage of positives has decreased from 48 per cent. in 1908 to 32 per cent. in 1909.

TABLE SHOWING ROUTINE AND SPECIAL DIPHTHERIA CULTURES CLASSIFIED.

	Special Cultures.		Routine Cultures.			
	Total.	Positives.	Total.	Positives.	% Positive.	Grand Total.
1908	133	69	259	119	46	392
1909	35	14	358	107	30	394

Eliminating the positive cultures of the special examinations in the two years, there has been an actual decrease in the number of routine positive cultures of 16 per cent. which may be taken as an indication that diphtheria was much less prevalent during 1909 than during 1908.

TABLE SHOWING LOCATION OF MEMBRANE OR EXUDATE.

Pharynx	*Tonsils*	*Larynx*	*Nares*	*Total*
19	201	20	5	245*

In all cases where the physician indicated that the pharynx or larynx were involved and the result was negative, a second specimen was requested.

TABLE SHOWING ELAPSED TIME BETWEEN DATE OF EARLIEST SYMPTOMS AND DATE OF TAKING SWAB.†

	2	3	4	5	6	7	8	9	10	14
1 day and under 67 . .	61	34	16	9	10	8	4	1	2	2

It would appear from this table that despite the fact that diphtheria is a disease where delay in beginning treatment is apt to result seriously, there is very often considerable delay either in calling a physician, or in the latter confirming his diagnosis by bacteriological methods. It is probable that in some of the cases showing the longest delay, the specimens were submitted for release from quarantine although not so indicated.

TABLE SHOWING ELAPSED TIME BETWEEN DATE OF TAKING SWAB AND DATE OF RECEIPT OF SPECIMEN.†

1 day	*2 days*	*3 days*	*4 days*	*5 days*
145	17	2	5	1

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*The remainder of the physicians did not submit this information.

†In a certain proportion of cases this information was not given.

In the eight cases where the time elapsed was greater than two days, information was requested of the physician as to the time and place of mailing and the matter then taken up with the Postoffice Department.

Swab examinations:—Since September 21st, 1909, smears have been made direct from every swab submitted after serum inoculations have been made. In 40 cases, a positive result was obtained and an immediate report made, effecting a saving of from 15 to 24 hours in each case. A negative swab examination has no value and an inoculation on serum is made with a subsequent examination after incubation.

Five hour examinations.—Since the above date all diphtheria specimens arriving at the laboratory prior to noon and on which the swab examination was negative have been placed in the 37° incubator and an examination made after five hours. In one case a positive result was obtained and the time of overnight incubation saved.

The types of diphtheria bacilli found on swabs and five hour examinations usually differ materially from those found after all night incubation. On this account no assistant is allowed to make these examinations without months of study on these special types. In one case a practically pure culture of the fusiform bacilli and spirilli characteristic of Vincent's Angina were discovered and the specimen so reported. In a second case the organisms of Vincent's Angina were found on the swab smear and diphtheria bacilli on the overnight incubation showing a complication of the two diseases.

TUBERCULOSIS.

TABLE SHOWING MONTHLY EXAMINATIONS CLASSIFIED.

	Positive.	Negative.	Unsatisfactory.	Total.
January	27	91	0	118
February	22	62	0	84
March	40	108	1	149
April	29	94	0	123
May	44	84	1	129
June	32	67	3	102
July	47	74	1	122
August	38	85	3	126
September	47	76	0	123
October	30	88	1	119
November	50	86	0	136
December	25	77	1	103
	431	992	11*	1,434

30%

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*Insufficient amount of sputum submitted.

The percentage of positive results remains the same as for 1907 and 1908, but the total number of examinations has increased from 1,255 to 1,434 or 179 more examinations for the year. The total number of patients on whom examinations were made was 1,340. 78 patients having two specimens examined and 8 having their sputum examined three times.

TYPHOID.

TABLE SHOWING NUMBER OF MONTHLY EXAMINATIONS CLASSIFIED.

	Positive	Negative.	Atypical.	Unsatisfactory.	Total.
January	3	7	0	0	10
February	8	7	0	0	15
March	15	11	0	1	27
April	14	4	0	3	21
May	7	3	0	1	11
June	20	5	1	1	27
July	32	11	1	0	47
August	63	52	15	4	134
September	131	47	10	2	190
October	56	15	3	2	76
November	39	18	4	0	61
December	14	23	3	0	40
	402	206	37	14	659

61%

The Widal examinations show an increase of 428 over 1908 and the percentage of the positive results an increase of 5%.

In the following cities and towns 10 or more positive results were obtained during the year.

Akron	44	Mansfield	97
Covington	16	Oberlin	22
Elyria	11	Wooster	10
Kent	25		

RABIES.

TABLE SHOWING MONTHLY EXAMINATIONS CLASSIFIED.

	Positive on Microscopical Examination.	Animal Inoculation.	Negative.	Unsatisfactory.	Total.
January	2	0	0	1	3
February	10	1	4	1	16
March	5	0	2	0	7
April	4	1	2	0	7
May	11	0	5	1	17
June	7	1	10	3	21
July	5	0	8	1	14
August	7	0	8	4	19
September	8	1	3	0	12
October	6	0	5	1	12
November	5	1	1	0	7
December	7	0	1	0	8
	77	5	49	12	143
	82				
	57.3%		34.3%	8.4%	

In only one case during the year did the microscopic examination fail to show Negri bodies and the subsequent animal inoculations reveal the presence of rabies. In all the other four cases where animal inoculations were made the latter were resorted to either because the portions of the brain necessary for the microscopical examinations had been shot away or were too soft for proper examination. The term "unsatisfactory" means that the brain when received was too soft for microscopical examination and too septic for animal inoculations even after being kept frozen for a considerable period of time.

According to the information which we were able to obtain 103 persons were bitten by the dogs submitted to us which were proven to be rabid while 67 persons in all were bitten by those dogs on which a negative report was rendered. One hundred and twenty-six dogs were bitten by those dogs proven by us to be rabid, giving an additional 44 new foci of infection.

The total number of examinations for 1909 was 143, an increase of 98 or 218%. The number of positive results, however, while numerically increased over 1908 by 50, shows a percentage decrease of 14%. This was to be expected since with the spread of the disease and of information concerning it, a request for an examination will be more likely to be made if a person is bitten regardless of other symptoms.

COST OF RABIES TO THE STATE.

Last year we estimated that the Pasteur Treatment for rabies had cost the state over $9,000.00 without taking into account the value of livestock destroyed. This year in order to get more accurate information, a circular letter was addressed to the commissioners of each county asking for answers to certain questions regarding the cost of rabies in each county with the following results:

Total number of counties in Ohio	88
Number replying	83
Number of counties in which persons were bitten by rabid animals	45
Amount of money paid to persons bitten to reimburse for cost of treatment	$22,701.63
Number of persons reported bitten	191
Average cost per person	$118.86
Number of counties where muzzling laws are not enforced	56
Number of towns or cities reported as enforcing or partially enforcing muzzling ordinances	16

Urbana
Xenia
Cincinnati
Findlay
Kenton
Ada
Logan
Bellefontaine
Camden
Gratis
West Elkton
Chillicothe
Montpelier
Carey
Upper Sandusky
Georgetown

Number of human cases (Franklin and Delaware counties)	2
Number of counties requiring pathological examination of head of dog as proof of presence of rabies	24
Number of counties requiring only the statement of physician of interested parties that dog was rabid	15
Number of counties requiring no proof	3

With 5 counties not reporting, it is probable that the total cost of rabies to the state will total at least $25,000.00 for the year. If the legislature would authorize the preparation of the anti-rabic virus by the State Board of Health, the total cost of treatment of the same number of persons would not exceed $5,000.00, this statement being based on estimates from other Pasteur Institutes maintained under Municipal, State or National auspices.

MISCELLANEOUS EXAMINATIONS BY MONTHS.

January	1	August	44
February	3	September	156
March	8	October	3
April	0	November	1
May	1	December	24
June	3		
July	1		245

The above table includes all special tests as follows:

194 samples water for B. coli only.
1 sample ice for B. coli and number of bacteria.
1 sample water containing white worm—(for method of destroying.)
1 sample water containing black worm—(for method of destroying.)
1 sample water for microscopical organism.
1 sample water for per cent of iron.
1 sample effluent for nature of microscopical organisms.
1 piece of iron pipe for percentage of iron in deposit.
1 sample lime for percentage strength.
1 sample soda ash for percentage strength.
5 samples alum for total aluminum, free H_2SO_4, etc.
1 sample "Clarine" for disinfecting properties.
2 samples sand for mechanical analysis.
1 sample bile for typhoid bacilli.
1 culture for nature of organism (diphtheroid group).
1 specimen blood for malaria organisms.
1 specimen for examination for glanders bacilli.
13 specimens of feces for typhoid bacilli.
1 specimen of feces for tubercle bacilli.
3 specimens urine for tubercle bacilli.
1 specimen pork for tubercle bacilli.
1 specimen for jaw bone for tubercle bacilli.
2 specimens pus for ulcer for nature of organism.
1 specimen of human parasite for species.
8 samples food (meat, milk, cheese, etc.) for ptomaine poisoning

WATER ANALYSES.

SHOWING MONTHLY EXAMINATIONS CLASSIFIED.

	Proposed Supplies.	Present Public Supplies.	Private Supplies.	Examination of Water from Columbus Tap.	Mahoning River Special Investigation.	Total.
January	11	24	22	27	0	84
February	16	32	9	15	81	153
March	9	56	21	14	0	100
April	4	59	12	31	0	106
May	29	53	13	16	0	111
June	3	14	15	22	0	54
July	9	42	31	27	0	109
August	27	34	86	21*	0	168
September	2	75	79	22*	0	178
October	16	7	49	23*	0	95
November	1	4	42	18*	0	65
December	8	22	17	24*	0	71
	135	422	396	260	81	1,294
Increase over 1908	64	251	87	260	21†	528

*Bacterial tests only. †Decrease.

SEWAGE AND TRADE WASTES.

	Number of Samples.		
January	46	August	17
February	38	September	32
March	13	October	149
April	9	November	53
May	14	December	6
June	23		
July	16		416*

Increase over 1908 — 223.

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*53 Examinations of Creamery Wastes.

WATER ANALYSES ON WATER SAMPLES FROM PRIVATE SOURCES.

MONTHLY EXAMINATIONS CLASSIFIED.

CAUSE FORR EXAMINATION.

	Typhoid.	Quality.	School Well.	Total.
January	20	1	1	22
February	8	0	1	9
March	17	4	0	21
April	9	3	0	12
May	12	1	0	13
June	12	3	0	15
July	26	5	0	31
August	83	3	0	86
September	67	11	1	79
October	44	5	0	49
November	33	9	0	42
December	15	2	0	17
	346	47	3	396

87%

The number of examinations because of typhoid in families using private supplies increased this year over last by 125 examinations or 16%, while the number of examinations for quality decreased 23 and the number of school wells 15.

TABLE SHOWING RESULTS OF ANALYSES FROM PRIVATE SOURCES, CLASSIFIED.

	Pure.	Suspicious.	Polluted.	Total.
January	12	7	3	22
February	5	3	1	9
March	12	5	4	21
April	4	5	3	12
May	7	3	3	13
June	7	6	2	15
July	15	7	9	31
August	46	16	24	86
September	50	13	16	79
October	32	11	6	49
November	31	5	6	42
December	11	3	3	17
	232	84	80	396
	59%	21%	20%	

The increase in the number of private wells examined is due to the general prevalence of rural typhoid throughout the latter part of the summer of 1909. Samples were evidently submitted on slighter evidence as the percentage of waters reported pure have increased 9% over 1908 and only 20% (a reduction of 10% over 1908) were reported distinctly polluted.

The present method of examining waters from private sources is far from satisfactory in that the samples are usually collected by inexperienced persons who do not appreciate the absolute necessity of carefully following directions. Add to this the fact that the information submitted regarding the surroundings is usually meager or inaccurate and it will be seen that in many cases the result obtained is valueless. This part of the work is being studied with a view to improving conditions.

In order to see how closely the information submitted agreed with the findings the following table has been made.

TABLE SHOWING COMPARISON OF RESULTS OF ANALYSES OF WATERS FROM PRIVATE SOURCES WITH LOCAL CONDITIONS.

(Quality examinations omitted.)

Surrounding stated to be good.			Surrounding stated to be unsatisfactory.		
Water Pure.	Water Polluted.	Total.	Water Pure.	Water Polluted.	Total.
177 70%	75 30%	252	20 23%	68 77%	88

Prior to May, 1909, it was seldom that information or a sketch showing surroundings, or relative distances from polluting sources, or the general slope of the land was submitted with the sample but by changing the wording of the information blank slightly and allowing room for a sketch directly below the request for same, very much better answers have been obtained.

It is probable that this class of work can be placed on a more satisfactory basis by some modification of the present system.

TABLE SUMMARIZING ROUTINE EXAMINATIONS FOR TEN YEARS, ENDING DECEMBER 31, 1909.

	Diphtheria.	Tuberculosis.	Typhoid.	Rabies	Miscellaneous.	Water Analyses.	Sewages and Wastes.	Total.
1899	14	1	3	0	23	613	0	654
1900	12	2	0	1	43	671	0	759
1901	68	6	1	0	41	493	0	609
1902	29	10	0	2	43	801	120	1,005
1903	178	10	1	5	16	954	0	1,194
1904	44	35	2	5	67	655	0	808
1905	296	814	141	9	42	450	126	1,878
1906	515	994	161	31	99	1,309	443	3,555
1907	475	1,189	169	34	102	1,107	151	3,227
1908	392	1,255	231	45	50	766	193	2,932
1909	394	1,434	659	143	245	1,294	116	1,585
	2,447	5,750	1,368	278	801	9,113	1,449	21,206

The increase in typhoid examinations is due to the increase in rural typhoid.

The increase in rabies work is due beyond contravention to the fact that little or no effort is being made by cities and towns to restrict the disease by muzzling, which failure can be laid at the doors of so-called humane people.

The large increase in diagnostic work, with the two exceptions above noted, is undoubtedly due in large part to the increase in the number of outfit stations which places the facilities of the laboratories within the convenient reach of a much greater number of physicians and to an effort to make the work of the laboratories more widely known.

By reorganizing and systematizing the work this increase has been taken care of without increasing the technical force.

The expenses of the laboratory during the year were:

Salaries	$8,476.58
Apparatus and supplies	2,836.40
Total	$11,312.98

Respectfully submitted,
Burt R. Rickards,
Chief of Laboratories.

CITY AND VILLAGE HEALTH OFFICERS.

Corrected to June 1st, 1910.

HEALTH OFFICERS OF CITIES AND VILLAGES.

Place.	Health Officer.
Aberdeen	Dr. A. R. Carregan.
Ada	Jacob Poling.
*Adamsville	Albert J. Tritlipo.
*Addyston	Noah Staton.
Adelphia	Jacob H. Karshner.
*Agosta P. O. (New Bloomington)	C. C. Mapes.
Akron	Dr. A. A. Kohler.
Albany	Walker Neff.
*Alexandria	William H. Proctor.
*Alger	Sant Newland.
Alliance	Dr. W. H. Burns.
Alvordton	John L. Rutledge.
Amanda	Geo. Boerstler.
*Amelia	Dr. Homer C. Behymer.
Amesville	J. C. Snedeker.
*Amherst	Dr. Washington Foster.
Amsterdam	T. J. James.
Andover	Wm. Shipman.
*Anna	D. R. Milliette.
*Ansonia	Dr. W. D. Cole.
*Antioch	Dr. D. W. Lowe.
*Antwerp	Andrew J. Schilb.
*Apple Creek	Harry H. Wilhelm.
*Arcadia	Joseph Boley.
Arcanum	Dr. W. B. Graham.
Archbold	August Ruihley.
Arlington	Thomas B. Trovinger.
*Arlington Heights	Wm. L. Goertemiller.
Arnettsville (Pitsburg P. O.)	
*Ashland	E. A. Kauffman.
*Ashley	Jas M. Worline.
Ashtabula	Dr. J. J. Hogan.
Ashville	John Johnson.
*Athalia	C. M. Defoor.
Athens	Dr. J. M. Higgins.
*Attica	J. C. Work.
Avon	Dr. John R. Pipes.
*Bainbridge	Dr. W. W. Davis.
*Bairdstown	J. J. Baird.
Bakersville	
Baltic	Simon P. Lower.
Baltimore	Noah B. Swartz.
*Barberton	Dr. Geo. A. Brown.
Barnesville	S. S. Foreman.
Barnhill	Lewis Just.
*Basil	T. F. Basch.

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* In lieu of a board of health.

Place.	Health Officer.
Batavia	Harry Dustin.
*Batesville	A. F. Dowden.
*Bay (North Dover P. O.)	
Beach City	Theodore F. Stamm.
*Bealisville	Dr. W. S. Burcher.
*Beaver	G. W. Miller.
Beaver Dam	Dr. E. C. Yingling.
Bedford	Dr. W. H. Black.
Bellaire	Dr. D. W. Boone.
Bellbrook	R. M. Martz.
*Belle Center	W. G. Oliphant.
Bellefontaine	Dr. A. J. McCracken.
*Belle Valley	Dr. Frank R. Dew.
Belleville	Dr. J. W. Kelly.
Bellevue	Dr. J. F. Miller.
Belmont	David Pangle.
Belmore	Dr. G. B. Adrian.
Beloit	R. H. Oswalt.
Belpre	Jesse McGrew.
Benton Ridge	Dr. R. D. Whisler.
Berea	Dr. A. A. Smith.
*Bergholz	Simon Speicher.
*Berlin Heights	Dr. G. W. Hine.
*Berne P. O. (Carlisle)	W. R. Bromhall.
*Bethel	Thomas E. Young.
*Bettsville	John E. Bronner.
Beverly	Fred H. Hart.
Bexley	Frank P. Holtzman, Mayor.
*Blakeslee	Mathias Thiel.
*Blanchester	A. Titus.
Bloom Center	Dr. O. C. Wilson.
*Bloomdale	G. W. Urie.
Bloomfield (Bloomingdale P. O.)	
*Bloomingburg	H. W. Worrell.
Bloomingdale P. O. (Bloomfield)	E. R. Blackburn, Clerk.
Bloomville	Dr. D. W. Fellers.
Bluffton	Dr. R. E. Hughson.
*Bolivar	John C. Lab.
*Boston (Owensville P. O.)	
*Botkins	Dr. Frederick R. McVay.
*Bourneville	Alvin A. Loiry.
*Bowerston	Harrison Karn.
*Bowersville	J. E. Steward.
Bowling Green	W. E. Avery.
*Bradford	B. H. Sothoron.
*Bradner	A. Chronister.
*Bratenahl	Alexis J. Imhoff.
*Bremen	Dr. A. A. Bradford.
*Bridgeport	Calder Fluharty.
Brilliant	Frank Barcus.
*Brinkhaven P. O. (Gann)	C. C. Leiter.

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*In lieu of a board of health

Place.	Health Officer.
*Brooklyn Heights	Joseph E. Richardson, Cleveland, R. F. D. 3.
*Brookside	Fred Elslager, Box 467, Bridgeport, O.
Brookville	B. F. Shafer.
*Broughton	Eli Berrier.
Bryan	August Heidley.
*Buchtel	Ralph Ball.
Buckeye City	F. M. Welker.
Buckland	Dr. R. W. Sharp.
Bucyrus	Dr. A. H. McCrory.
Buffalo (Hamlet)	Charley Frye.
*Burbank	A. W. Hoffman.
Burkettsville	Dr. B. G. Inman.
*Burton	Dr. A. D. Warner.
*Butler	John W. Long.
*Butlerville	Elias Smith.
*Byesville	D. Lewis Davis.
*Cadiz	Dr. Wm. H. Lemmon.
Calais	J. R. Johnson, Acting.
*Caldwell	W. L. Evans.
Caledonia	Noah Lee.
Cambridge	Dr. W. T. Ramsey.
*Camden	Dr. Geo. W. Homsher.
*Canal Dover	Dr. H. H. Prince.
Canal Fulton	Wm. Logan.
*Canal Winchester	Dr. J. W. Shook.
Canfield	Roscoe A. Brown.
*Cannelsville (Dillon P. O.)	
Canton	Dr. Frank DaHinden.
*Cardington	C. F. Axthelm.
*Carey	Joseph F. Wonder.
*Carlisle (Berne P. O.)	
Carroll	Dr. H. L. Bounds.
Carrollton	Dr. A. H. Hise.
*Carthage	Dr. Odus D. Simmons.
*Casstown	Dr. W. W. Baker
Catawba	Forest Mahar.
*Cecil	Dr. F. W. McNamara.
Cedarville	Samuel Albright.
Celina	Dr. Joseph Sager.
Centerburg	Leo Dally.
*Centerville (Montgomery Co.)	Dr. B. W. Dudley Keever.
Centerville (Gallia Co.) Thurman P. O.	
*Chambersburg (Eureka P. O.)	
*Chagrin Falls	John W. Steever.
*Chardon	Rufus Smith.
*Chatfield	Samuel Lutz.
Chauncey	W. T. Sprague.
*Chesterhill	Wm. Johnson.
*Chesterville	C. W. Mather.

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* In lieu of a board of health.

Place.	Health Officer.
*Cheviot	L. S. Getzendanner.
Chicago	Dr. A. R. Kauffman.
*Chickasaw	John P. Kroeger.
Chilicothe	Dr. W. S. Scott.
Cincinnati	Dr. J. H. Landis.
Circleville	Harry S. Sheets.
*Clarington	Dr. J. W. Parkhill.
*Clarksburg	
*Clarksville	Eli Gray.
Cleveland	Dr. Martin Friedrich.
*Cleveland Heights	Dr. Emil H. Stone.
*Cleves	Dr. Fred A. Grossman.
*Clifton	Dr. Frank C. Adams.
Clifton (Fitchville P. O.)	
*Cloverdale	Dr. Frank O. Hunt.
Clyde	George Snavely.
*Coal Grove	Dr. William Shattuck.
*Coalton	J. R. Maddox.
*Coldwater	Dr. F. H. Brumm.
*College Corner	Chris Haacke.
College Hill	J. E. Deininger.
Columbiana	Thomas J. Lyon.
Columbus	Dr. J. W. Clemmer.
*Columbus Grove	Dr. N. Seaman.
*Commercial Point	Harry Trego.
Congress	L. O. Weiler.
Conneaut	Dr. R. J. Baxter.
*Continental	M. G. Pease.
Convoy	Dr. C. D. Sidle.
Coolville	Dr. A. M. Frame.
Copley	
Corlett	Dr. Arthur M. Cheetham, Cleveland.
*Corning	Wm. Anderson.
Cortland	Dr. B. G. McCurley.
*Corwin	Jacob I. Clark.
Coshocton	E. G. Abbott.
Covington	Wm. E. Westfall.
Crestline	Dr. C. A. Marquart.
*Creston	Christian Schlegel.
Cridersville	J. M. Woodruff.
*Crooksville	Dr. John M. Dennison.
*Croton P. O. (Hartford)	Dr. C. B. Hempstead.
*Crown City	Dr. E. M. Martindill.
*Cumberland	D. T. Phelps.
Curleyville	
*Custar	Dr. H. V. Fall.
*Cuyahoga Falls	William W. Seulpholm.
*Cygnet	Dr. E. W. Misamore.
*Dalton	Dr. J. Coleman Haney.
Danville	Dr. T. E. Jefferson.

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*In lieu of a board of health.

Place.	Health Officer.
Darbyville (Orient R. F. D. 1)	
Dayton	Dr. C. L. Patterson.
*Deavertown	John H. James.
Deerfield (So. Lebanon P. O.)	
Deersville	W. C. Birney.
Defiance	Dr. J. D. Westrick.
*DeGraff	Thos. H. Markeson.
Delaware	Dr. A. J. Pounds.
*Delhi	C. B. Davis.
*Dell Roy	Dr. S. B. Lechner.
*Delphos	Dr. N. E. Brandage.
Delta	Geo. A. Everett.
Dennison	Dr. L. H. Hughes.
*Deshler	M. G. Coats.
*Dexter City	J. A. Bower.
*Dillon P. O. (Cannelsville)	Dr. Chas. A. Dunn.
*Dillonvale	John W. Howell.
Donnelsville	Dr. Horace Heistand.
*Doylestown	Ed. Dannemiller.
Dresden	Louis Swope.
Drusilla (Cloverdale P. O.)	
*Dublin	John A. Wise.
Dunkin Falls	
*Dunkirk	Dr. C. C. McLaughlin.
*Dupont	Robert Nichols.
East Cleveland	J. H. Stamberger.
East Fairfield	Dr. G. H. Albright.
East Liverpool	Dr. C. B. Ogden.
*East Palestine	Dr. J. M. Van Fossan.
*East View (Warrensville P. O.)	
Eaton	John W. Harris.
Edgerton	Dr. C. Hathaway.
*Edison	Dr. Jno. H. Jackson.
Eden	Geo. Brady.
Eldorado	Geo. W. McCoy.
Elgin	Geo. R. Hill.
Elida	Dr. H. Q. Alexander.
Elmore	Dr. S. T. Dromgold.
Elmwood Place	Dr. E. T. Busching.
Elyria	Dr. George E. French.
Empire	John Hunter.
Enon	B. C. Hebble.
*Euclid	Dr. H. B. Harper.
*Eureka P. O. (Chambersburg)	Dr. W. J. Fletcher.
*Fairfield	M. W. Lasure.
Fairmount (Hamlet)	L. Hunter, Clerk.
*Fairport (Fairport Harbor P. O.)	F. T. Johnston.
Fairview	C. M. Ault.
*Farmersville	C. M. Boemershine.
*Fayette	Benjamin Stoner.
*Fayetteville	Dr. E. W. Love.

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* In lieu of a board of health.

Place.	Health Officer.
*Felicity	J. L. Viers.
*Fernbank	James E. Hickman.
Findlay	Amos Beardsley.
Fitchville P. O. (Clinton)	S. M. Sly.
Fletcher	Dr. I. C. Kiser.
Florida	Wm. Thompson.
*Flushing	Ralph James.
Forest	John Handchy.
Fort Jennings	Fred Heising.
Fort Recovery	Dr. C. W. Robinson.
Fostoria	W. N. Caldwell.
*Frankfort	John A. Davis.
*Franklin	John B. Miller.
*Frazeysburg	George W. Holtz.
*Fredericksburg	T. F. Richards.
Fredericktown	Dr. J. H. Norrick.
*Freeport (Harrison Co.)	Philetus Steel.
Freeport (Prairie Depot P. O., Wood Co.)	
Fremont	Dr. E. L. Vermilya.
Fultonham P. O. (Uniontown)	Dr. C. Z. Axline.
Gahanna	D. L. Stygler, Mayor.
Galion	Dr. E. D. Helfrich.
Gallipolis	Chas. B. Robinson.
Gambier	Dr. A. D. Welker
Gann (Brinkhaven P. O.)	
*Garrettsville	Charles D. Allen.
Geneva	Dr. F. C. Smith.
*Genoa	Edward Myers.
*Georgetown	Geo. Innis.
*Germantown	William Shaeffer.
*Gettysburg	Samuel Hershey.
*Geyer	Jas. Killian.
Gibsonburg	J. P. Tierney.
Gilboa	Dr. Bruce Snodgrass.
Girard	Dr. W. S. Thompson.
Glandorf	Dr. Felix C. Harman.
*Glendale	Clifford Allen.
Glenmont	J. C. Bresson, Secretary.
Glenville	
Glouster	Dr. H. G. Gibson.
*Gnadenhutten	Thomas J. Lukens.
Good Hope	D. C. Somers.
*Gordon	Dr. H. Z. Silver.
*Grafton	Henry Trau.
Grand Rapids	Wm. E. Kerr.
Grand River P. O. (Richmond)	H. S. Barton.
*Grandview Heights	Dr. McKendree Smith, Sta. A., Columbus.
Granville	Dr. A. K. Follett.
Gratis P. O. (Winchester, Preble Co.)	Fred Boesenberg.

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* In lieu of a board of health.

Place.	Health Officer.
Graysville	W. E. Barker.
*Green Camp	John Cannine.
*Greenfield	C. S. Clouser.
Green Spring	Dr. R. D. Reynolds.
Greenville	S. A. Hawes.
*Greenwich	John H. Baker.
*Grove City	Chas. Donaldson.
Groveport	Dr. C. R. Clement.
Grover (Tiltonville P. O.)	
*Grover Hill	G. W Morris.
Hamden Junction	F. T. Harper.
*Hamersville	H. E. Hannah.
Hamilton	Dr. Mark Millikin.
Hamler	William Fye.
Hanging Rock	Joseph Kinkaid, Sr.
*Hanover	Dr. W. L. Evans.
Hanoverton	Newton Steller.
*Harrisburg	Albert Deyo.
Harrison	Bruce Hardin.
Harrisville	W. F. Lemmon.
*Harrod	Chas. R. Boyer.
*Hartford (Croton P. O.)	
Hartford (Trumbull Co.)	Dr. C. W. Banks.
Hartwell	George F. Laxford.
Harveysburg	Charles McMillan.
*Haskins	William H. North.
*Haviland	Myron A. Hanna.
Hayesville	Dill Andress.
*Hebron	W. D. Lietz.
Hemlock	Dr. R. W. Miller.
Hicksville	B. L. Kelsey.
*Higginsport	Dr. Clement D. Smedley.
*Hilliards	Dr. J. W. Reason.
Hillsboro	Dr. J. D. McBride.
Hiram	Dr. F. H. Hurd.
*Holgate	Adam Kemmer.
*Hollansburg	Dr. W. B. Roads.
*Holloway	O. A. VanFossen.
Holmesville	C. W. McClelland.
Home City	Dr. B. F. Lehman.
*Hopedale	Chas. M. Miller.
*Hoytville	James Nichols.
Hubbard	Dr. W. H. Button.
Hudson	Dr. H. C. Coolman.
*Huntsville	Dr. Frank A. Richardson.
*Huron	Robert Day.
Independence	
Ironton	Dr. E. E. Wells.
Ithaca	Dr. J. C. Hamilton.
Jackson	John W. Laird.
Jacksonboro	John Stamm.

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* In lieu of a board of health.

Place.	Health Officer.
*Jackson Center	A. A. Davis.
*Jacksonville	Henry Wolfe.
Jamestown	Harry C. Lieurance.
*Jefferson	W. S. Andrews.
*Jeffersonville	E. W. Bargdill.
Jenera	C. H. Heldman.
*Jeromeville	Simon L. Davis.
Jerry City	Austin VanBlarcum.
*Jerusalem	I. B. Carleton.
*Jewett	Frank W. Beckett.
Johnsonville	E. C. Hitchcock.
Johnstown	Dr. E. S. Rutledge.
Junction City	Dr. H. W. Shaw.
*Kalida	Dr. W. J. Francis.
Kelleys Island	Geo. P. Schardt.
*Kenmore	Dr. Earl Z. Alspach.
*Kennedy P. O. (Kennedy Heights)	P. W. Reinsagen.
Kent	F. H. Vickers.
Kenton	Joe Bonham.
*Kettlerville	Dr. O. O. Lemaster.
Killbuck	William C. Stont.
Kimbolton	F. M. Fowler.
Kingston	F. P. Long.
*Kirby	Dr. E. E. Burns.
*Kossuth	Jesse Conner.
Lafayette	Dr. A. C. Adams.
LaGrange	Dr. J. W. Lindsey.
Lakeside	Dr. O. L. Mapes.
*Lakeview	Everett L. Frey.
Lakewood	Dr. A. E. McClure.
Lancaster	Dr. J. P. Hershberger.
*Larue	Dr. Finley Van Orsdall.
Latty	Alfred Smith.
*Laura	Dr. Chas. Rufus Coate.
Laurelville	Dr. W. D. Cain.
Lebanon	Dr. A. W. Mardis.
*Leesburg (Leesville P. O. Carroll Co.)	
*Leesburg, Highland County)	Dr. K. R. Teachnor.
*Leesville P. O. (Leesburg)	W. C. Sharp.
Leetonia	Dr. S. R. McCready.
*Leipsic	Dr. J. C. McClung.
*LeRoy	Henry Rice.
Lewisburg	A. N. Cox.
Lewisville	V. E. Dillon.
*Lexington	Dr. J. P. Stober.
Liberty Center	
Lima	Dr. A. L. Jones.
*Limaville	S. E. Beltz.
*Linden Heights	T. M. Dodds.
*Lindsey	Jno. H. Roush.
*Lisbon	David H. Eells.

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* In lieu of a board of health.

Place	Health Officer.
*Lithopolis	E. E. Myers.
Little Sandusky	
*Lockbourne	M. K. Barnes.
Lockington	Dr. J. Robt. Caywood, Clerk.
*Lockland	Valentine Harting.
*Lodi	A. W. Kinney.
*Logan	Dr. Edward E. Campbell
*London	Dr. John W. Parker.
Lorain	Dr. Edw. V. Hug.
*Loramie	Fred Anthony.
*Lore City	C. F. Milligan.
Loudonville	Walter S. Young.
Louisville	Dr. F. W. Schilling.
*Loveland	Dr. J. D. Wakefield
Lowell	A. J. Thompson.
*Lowellville	W. S. Baker.
Lower Salem	J. P. Hartshorn.
*Lucas	Dr. J. M. Heyde.
*Lynchburg	Robert M. Lewis.
*Lyons	Dr. Thos. Blair.
*McArthur	Milton L. Pearce.
McClure	E. E. Britton.
*McComb	James H. Byal.
McConnelsville	Edgar Sharp.
McGuffey	Dr. J. B. K. Evans.
*Macedonia	P. B. Seacoy.
*Macksburg	Samuel H. Dyer.
*Madison	Dr. Chas. H. Quayle.
Madisonville	Dr. C. L. Metz.
Magnetic Springs	Dr. M. B. Newhouse
*Magnolia	Daniel K. Conrad.
*Maineville	James G. Hill.
Malinta	W. M. Hess.
Malta	W. R. Scott.
Malvern	
Manchester	R. W. E. Irwin.
Mansfield	Dr. M. J. Davis.
Mantua	E. H. Knowlton, Clerk.
Marble Cliff	
Marblehead	L. M. Clemmons.
*Marengo	I. E. Eakins.
Marietta	Dr. F. S. McGee.
Marion	Addison Bain.
*Marseilles	Dr. E. S. Jones.
*Marshallville	Daniel K. Conrad.
*Martinsburg	Dr. W. E. Shrontz.
Martins Ferry	Dr. J. W. Darrah.
Martinsville	John F. Wells.
*Marysville	Dr. H. G. Southard.
Mason	Dr. M. H. Houseworth.
Massillon	Dr. T. Clarke Miller.

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*In lieu of a board of health.

Place.	Health Officer
*Matamoras (New Matamoras P. O.) ..	
*Maumee	Philip Hartman.
Mechanicsburg	Dr. H. Dickson.
*Medina	E. T. Pierce.
*Melrose	T. J. Myers.
*Mendon	B. T. Price.
*Mentor	Dr. J. W. Lowe.
Metamora	Elmer Duncan.
Miamisburg	Dr. William Shuler.
Middleburg	C. C. Heath.
Middlefield	Dr. F. S. Clapp.
Middle Point	Dr. W. H. Beery.
Middleport	Dr. David Sisson.
Middletown	Dr. George D. Lummis.
Midland (Midland City P. O.)	
Midland City P. O.	Dr. A. B. Martin.
Midway (Sedalia P. O.)	
*Mifflin	George Fulmer, R. F. D. 8, Ashland.
*Milan	J. W. Seeley.
*Milford	Dr. C. J. Spence.
*Milford Center	Oscar Miller.
Millbury	Dr. C. M. Diebert.
Milledgeville	Dr. W. T. Mathews.
*Miller City	Dr. Louis E. Deuble.
Millersburg	Chas. A. Estill.
*Milton (West Milton P. O.)	
Milton Center	Dr. J. F. Noble.
*Miltonsburg	Dr. Chas. R. Keyser.
Mineral City	Dr. F. L. Nape.
*Mineral Ridge	Edward Blunt.
*Minerva	Elmer E. Fultz.
*Mingo Junction	David E. Jordan.
*Minster	Louis Budde.
*Mogadore	Wm. Saxe.
*Monroe	Jerome Warner.
Monroeville	Dr. E. R. Kreider.
*Montezuma	R. E. Wills.
Montpelier	Dr. J. V. Lesnet.
*Morristown	Joshua DeWees.
*Morral	Fred McCumber.
Morrow	Dr. Leonard Mounts.
Moscow	Dr. W. S. Purkhiser.
Mt. Airy	
Mt. Blanchard	Samuel E. Moore.
Mt. Cory	E. E. Cramer.
Mt. Eaton	Dr. C. N. Clark.
*Mt. Gilead	Dr. Geo. H. Pugh.
*Mt. Healthy	Dr. Lafayette Neufarth.
Mt. Pleasant	Thomas O. DeVault.
*Mt. Orab	Walter L. Remley.

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*In lieu of a board of health

Place.	Health Officer.
*Mt. Sterling	B. H. Edgington.
Mt. Vernon	Dr. H. W. Blair.
Mt. Victory	Dr. A. W. Titsworth.
*Mt. Washington	Dr. W. C. Langdon.
Murray City	Dr. E. H. Hayman.
Mutual	C. M. Goul.
Napoleon	D. H. Hancock.
*Nashville	Chas. Campbell.
Navarre	John Bailiss.
Nelsonville	Dr. J. M. Hyde.
*Nevada	Dr. S. S. Barrett.
Neville	F. M. Neal.
*New Albany	[illegible] M. Heischmann
*New Alexandria	Dr. C. E. Gourley.
Newark	Dr. W. H. Knauss.
New Athens	Dr. A. B. Tubbs.
*New Berlin	Jas. R. Brown
*New Bloomington (Agosta P. O.)	
New Boston	Dr. W. G. Chaney.
*New Bremen	Dr. G. A. Havermann.
Newburg Heights (Willow P. O.)	
*New Carlisle	D. F. Akers.
Newcomerstown	Wm. Tidrick.
*New Concord	
*New Holland	Thomas Doyle.
New Knoxville	Dr. H. E. Fledderjohann.
*New Lebanon (Potsdam P. O.)	
*New Lebanon	Lutie Piatt.
New Lexington (Highland P. O.)	
*New Lexington, Perry County,	Byron E. Stowe.
New London	Wm. H. Whitney.
*New Madison	Harry Coblentz.
*New Matamoras P. O. (Matamoras)	J. R. Johnston.
*New Paris	Dr. E. E. Bevington.
New Philadelphia	Dr. George H. Peck.
New Richmond	Dr. C. F. Hera.
*New Reigel	George Lonsway.
*New Salem	Dr. W. R. Carle.
*New Straitsville	Samuel P. McClain.
*Newton Falls	Dr. H. A. Fiester.
*Newton	Dr. C. R. Campbell.
*New Vienna	Dr. J. A. Mercer.
*New Washington	George B. Wolf.
*New Waterford	Geff. Wetzerman.
*New Weston	Dr. A. Pearson.
*Ney	Dr. Park M. Lehman.
*Niles	Dr. H. S. Brown.
North Baltimore	Charles Lano.
*North Bend	Wm. Wiesman.
*North Dover P. O. (Bay)	George L. Osborn.
North Lewisburg	G. L. Freeman.

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* In lieu of a board of health.

Place.	Health Officer
North Lindale	Hugh Geariety.
*North Robinson	Harry G. Smith.
Norwalk	Lewis Fiesinger.
*Norwich	Joseph H. Hammond.
Norwood	Dr. J. C. Cadwallader.
*Nottingham	Dr. W. O. Jenks.
Oak Harbor	Dr. E. B. Huyck.
Oak Hill	Wm Jenkins.
*Oakley	Dr. Herman H. Schulze.
*Oakwood	A. M. Morgan.
Oberlin	S. S. Vanausdall.
Ohio City	G. A. Balliet
*Olmstead Falls	F. R. Gallagher.
*Orangeville	Dr. W. C. Holbrook.
Orrville	Dr. A. A. Brooks.
Osborn	D. E. Coy.
*Osgood	H. C. Miller.
*Osnaburg	Dr. Wm. D. Davis.
*Ostrander	Jasper F. McKitrick.
*Ottawa	Dr. E. L. Tupper.
*Ottoville	Dr. John F. Oekuly.
Otway	Simon Crow.
*Owensville P. O. (Boston)	Dr. G. G. Rutledge.
*Oxford	Dr. Charles O. Munns.
Painesville	S. A. Haskill.
*Palestine	Milton Keener.
Pancoastburg P. O. (Waterloo)	
*Pandora	Dr. I. D. Bixel.
Pataskala	Dr. B. B. Ashbrook.
Patriot	
Patterson	Benjamin Trobridge.
Paulding	Dr. E. A. Clark.
*Payne	Levi Reynolds.
*Peebles	Dr. George F. Thomas.
Pemberville	Dr. E. M. Collier.
*Peninsula	M. J. Harrigan.
Perrysburg	Dr. D. R. Canfield.
Perrysville	Dr. L. D. Hyatt.
Phillipsburg	S. A. Mosby, Secretary.
Philo P. O. (Taylorsville)	A. Dearstine.
*Pickerington	Frank Bish.
*Piketon	H. S. Cutler.
*Pioneer	Arthur F. Norris.
Piqua	Dr. F. E. Kitzmiller.
Pittsburg P. O. (Arnettsville)	Dr. J. O. Starr
*Plain City	Frank Jackson.
*Plainfield	J. R. Gaumer.
*Pleasant City	J. F. Secrest.
Pleasant Hill	Dr. Judson Teeter.
*Pleasant Ridge	C. H. Bowlby, D. D. S.
*Pleasantville	L. Jay Brooke.

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* In lieu of a board of health.

Place.	Health Officer.
Plymouth	Dr. J. Frank Holtz.
Poland	Dr. C. R. Justice.
Polk	Dr. W. H. Rhinehart.
*Pomeroy	Dr. L. G. Gribble.
*Portage	G. R. Haight.
Port Clinton	Dr. J. G. Yingling.
*Port Jefferson	Dr. D. J. Cargill.
Portsmouth	Dr. James B. Ray.
Port Washington	Dr. F. B. Larimore.
*Port William	Dr. Paul D. Espey.
*Potsdam P. O. (New Lebanon)	Dr. D. W. Shellabarger.
Powhatan Point	S. J. Fankhauser.
*Prairie Depot P. O. (Freeport)	H. E. West.
Proctorville	Dr. R. E. Atkinson.
Prospect	G. F. Gast.
Put-in-Bay	Adam Heidle.
Quaker City	Eli Hayes.
Quincy	Dr. N. V. Speece.
*Racine	Dr. John Philson.
*Rarden	Dr. R. A. Foster.
Ravenna	Henry J. Shreader.
Rawson	A. C. Dicus.
*Reading	Leo Grau.
*Rendville	William H. Shelton.
*Republic	Samuel J. Beard.
*Reynoldsburg	Worral L. Orem.
Richmond (Grand River P. O.)	
Richmond, Jefferson County,	Dr. Samuel Rothacker.
Richwood	J. F. Ledley.
*Ridgeway P. O. (West Ridgeway)	Dr. E. E. Lynch.
*Ripley	Dr. A. W. Francis.
*Rising Sun	James Gangwer.
*Rochester	D. C. Mann.
Rockford	George Kimble.
*Rock Creek	J. E. Gladding.
Rockport (West Park P. O.)	
*Rockyridge	S. R. Curran.
*Rocky River	Jacob Burkeman.
*Rogers	William M. Green.
Rome (Stouts P. O.)	
*Roscoe	Samuel T. Dobson.
*Roseville	W. H. Garrett.
*Rossburg, P. O. (Rossville)	C. W. Wheeler.
Rossville (Rosburg P. O.)	
Rushsylvania	W. H. Drum.
*Rushville	Dr. W. C. Lewis.
Russellville	M. Breen.
*Sabina	I. H. Burris.
St. Bernard	Dr. Harry C. Wayble.
*St. Clairsville	Dr. S. L. West.
St. Henry	Dr. J. A. Schirack.

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* In lieu of a board of health.

Place.	Health Officer.
St. Louisville	Dr. L. L. Marriott.
St. Marys	Dr. J. E. Heap.
*St. Paris	Dr. H. Rush Zeller.
Salem	Dr. E. J. Schwartz.
*Salesville	Joseph R. Dement.
*Salineville	Dr. H. M. Calvin.
Sandusky	Dr. W. D. Hoyer.
*Sarahsville	Jonah Grimes.
*Sardinia	L. K. Hite.
*Savannah	Simon Stahl.
Scio	Dr. G. D. Custer.
Sciotoville	
*Scott	B. W. Harvey.
Sebring	Lee Shively.
Sedalia P. O. (Midway)	Dr. E. B. Mead.
*Senecaville	Frank Morrison.
*Seven Mile	C. B. Wilson.
Seville	Dr. P. E. Beach.
*Shanesville	Dr. R. J. Strempfer.
*Shawnee	L. A. Spencer.
Shelby	Dr. Roy E. Smucker.
*Sherodsville	Richard Redfern.
Sherwood	Dr. H. C. Lindersmith.
*Shiloh	Dr. Ralph B. Tate.
*Shreve	James H. Andress.
Sidney	Wm. C. Wyman.
*Silverton	Dr. A. A. Sprague.
*Sinking Springs	Dr. J. E. Chapman.
Smithfield	Ross C. Moore.
*Smithville	W. G. Zimmerman.
Somerset	Dr. Michael Clouse.
*Somerville	Sidney A. Macy.
South Bloomfield	
*South Charleston	Wm. McGree.
South Lebanon P. O. (Deerfield)	Dr. V. T. Reynolds.
*South Point	Dr. Wm. Wilson Lind.
*South Salem	Albert Waldren.
South Solon	Dr. Fred L. Wilson.
*South Webster	S. S. Ferguson.
*South Zanesville	O. L. Boal.
Sparta	Dr. T. A. Huggins.
Spencerville	G. A. Rusler.
*Springboro	J. B. Haines.
*Spring Hill	Dr. George E. Kerns.
Springfield	Dr. Henry Baldwin.
*Spring Valley	Dr. R. W. Smith.
*Stafford	W. H. Ullmann.
Steubenville	John Welch.
Stewart	Mr. G. H. Hawk.
*Stockport	Dr. T. J. Lyne.
Stouts P. O. (Rome)	Dr. R. Y. Littleton.

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* In lieu of a board of health.

Place.	Health Officer.
Strasburg	Dr. J. C. Schutzbach.
Struthers	S. D. Strain.
*Stryker	John E. Meek.
Sugar Creek	Mahlon Neff.
*Sugar Grove	Dr. T. R. Mason.
Summerfield	John Baughin.
Summerford	
Sunbury	J. A. Wilson.
Swanton	B. F. Mills.
*Sycamore	Dr. I. B. Gibbs.
*Sylvania	A. D. Lewis.
*Tarlton	Benjamin F. Duumn.
Taylorsville (Philo P. O.)	
Terrace Park	Dr. John K. Scudder.
*Thornville	Dr. Harry L. Hite.
Thurman P. O. (Centerville)	
Tiffin	Dr. W. H. Benner.
Tiltonville P. O. (Grover)	Henry W. West.
Tippecanoe City	F. N. Agenbroad.
Tiro	Dr. G. O. Blair.
Toledo	Dr. B. Becker.
*Tontogany	Dr. Thomas A. Bickerstaph.
*Toronto	Joseph Chaine.
Trenton	Edward Kopp.
*Trimble	Harvey Wyne.
Trinway	LeRoy Rose.
*Trotwood	George C. Bunnell.
Troy	Dr. J. S. Shinn.
*Tuscarawas	C. F. Veigel.
Uhrichsville	Dr. J. E. Groves.
Union City	Francis Bourguin.
Uniontown (Fultonham P. O.)	
*Unionville Center	Dr. C. O. McCune.
Uniopolis	Dr. J. E. Bayliff.
*Upper Sandusky	Dr. O. C. Stutz.
Urbana	Dr. Richard T Henderson.
*Utica	C. D. Morris.
Van Buren	O. Robbins.
*Vandalia	Dr. W. H. Riley.
Vanlue	Dr. James L. Schrote.
Van Wert	Dr. C. G. Church.
Venedocia	John E. Jones.
Vermillion	H. T. Baldwin.
Versailles	Dr. C. F. Ryan.
Vienna (South Vienna P O.)	Dr. E. A. Dye.
*Vinton	Dr. J. C. Strausbaugh.
*Wadsworth	Clint Waffle.
Waldo	Dr. Robert S. Dombaugh.
Wapakoneta	George P. Steck.
Warren	Dr. George N. Simpson.
*Warrensville P. O. (East View)	Charles C. Murfett.

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*In lieu of a board of health.

Place.	Health Officer.
Warsaw	S. W. Willis.
*Washington	Dr. J. M. Thompson.
Washington, C. H.,	S. A. Murry.
*Washingtonville	Dr. S. V. Kennedy
Waterloo (Pancoastburg P. O.)	
*Waterville	Dr. D. B. Buck.
*Wauseon	C. B. Onsted.
*Waverly	James J. Emmitt.
*Waynesburg	Wm. Waggoner.
Waynesfield	Amos Shockey.
Waynesville	Dr. Thos. Sherwood.
Webster	J. F. Byrd.
Wellston	James R. Ward.
*Wellington	E. D. Snyder, V. S.
Wellsville	Dr. M. C. Tarr.
*West Alexandria	C. B. Dye.
West Cairo	Dr Charles E. Stadler.
*West Carrolton	Abraham Simpson.
West Cleveland	
West Elkton	Dr. Elwood Holaday.
Western Star	Fred Becker, Wadsworth, R. F. D. 2.
Westerville	Dan Dusenberry.
West Farmington	Albert Ostrom.
West Jefferson	James McCarty.
West Lafayette	W. C. Wiggins.
*West Leipsic	W. C. Miller.
*West Liberty	Dr. G. B. Hale.
*West Manchester	A. J. Hartzell.
*West Mansfield	Dr. W. T. Sullivan.
West Millgrove	Dr. C. B. Hatfield.
*West Milton P. O. (Milton)	Dr. Herbert R. Pearson.
Weston	Dr. J. W. Williams.
*West Park P. O. (Rockport)	Dr. Charles L. Wood, Lakewood.
West Ridgeway (Ridgeway P. O.)	
West Rushville	Wm. Kerr.
*West Salem	Dr. E. C. Radebaugh.
West Union	Dr. James W. Bunn.
*West Unity	S. I. Rose.
Wharton	William Krider.
*Whitehouse	Harry Hopewood.
Wilkesville	Dr. G. W. Martin.
*Williamsburg	Dr. O. B. Martin.
Williamsport	Dr. D. H. Marcy.
Willoughby	James Maloney.
Willow P. O. (Newburg Heights)	Dr. F. E. Farrer.
*Willshire	Dr. Samuel K. Christy.
Wilmington	Dr. E. C. Briggs.
Wilmot	Dr. O. Curtis Ricksecker.
*Winchester (Adams Co.)	Dr. T. H. Trout.

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* In lieu of a board of health.

Place.	Health Officer.
Winchester (Gratis P. O.) Preble Co...	
Windham	H. J. Higley.
*Woodsfield	Louis Hoeffler.
Woodstock	D. P. Smith.
Woodville	Dr. R. M. Durbin.
Wooster	Dr. Wm. A. Welch.
*Worthington	T. E. Albert.
Wren	Nelson Moser.
Wyoming	Fred L. Townley.
Xenia	Dr. A. C. Messenger.
Yellow Springs	Wm. Loe.
*Yorkshire	Ira Hess.
Youngstown	Dr. H. E. Welch.
Zaleski	J. W. Crist, Mayor.
*Zanesfield	Dr. O. H. McDonald.
Zanesville	Dr. G. W. McCormick.
*Zoar	Christian Ruof.

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* In lieu of a board of health.

INDEX.

A

PAGE

Aetna Paper Company—
  Report on wastes from.. 29
Akron—
  Complaint and proceedings under Bense Act..............14, 64, 91, 254
  Change in water supply for.. 39
Alliance—
  Complaint and proceedings under Bense Act.......................77, 83
  See Report on Mahoning River.. 286
  Sewage purification for..56, 172
  Water supply of.. 352
Antitoxin—
  Distribution of 87
  List of distributing stations.. 433
Antitoxin and anti-rabic serum—
  Legislation for distribution of..47, 68
Apple Creek—
  Water supply for..30, 51, 98
Archbold—
  Sewerage and sewage purification for..51, 180
Athens—
  Storm water sewers for..52, 183
Auglaize County Infirmary—
  Sewage purification for..23, 184

B

Barnesville—
  Use of water work reservoir for fishing purposes..................30, 31
Batavia—
  Investigation of typhoid fever at.. 87
Bellaire—
  Complaint and proceedings under Bense Act.............................. 14
Bense Act—
  Complaint and proceedings against Aetna Paper Company............. 29
  Complaint and proceedings against Akron................14, 64, 91, 254
  Complaint and proceedings against Alliance........................77, 83
  Complaint and proceedings against Bellaire.............................. 14
  Complaint and proceedings against Bowling Green..................... 83
  Complaint and proceedings against Bryan......................14, 62, 90
  Complaint and proceedings against Bucyrus........................14, 31
  Complaint and proceedings against Cambridge..................20, 26, 77
  Complaint and proceedings against Collinwood..14, 50, 55, 61, 90, 94, 258
  Complaint and proceedings against Darke County Infirmary.........20, 26
  Complaint and proceedings against Dayton................14, 63, 90, 263
  Complaint and proceedings against Delphos........................46, 77
  Complaint and proceedings against Elmore................20, 26, 77, 90
  Complaint and proceedings against Fostoria........................57, 62

PAGE

Bense Act—Concluded.
  Complaint and proceedings against Greenville........................58, 83
  Complaint and proceedings against Ironton........................14, 93
  Complaint and proceedings against J. A. Long & Company............ 14
  Complaint and proceedings against Marysville..................20, 26, 78
  Complaint and proceedings against National Military Home........... 78
  Complaint and proceedings against New Philadelphia.......14, 31, 43, 267
  Complaint and proceedings against Niles..........14, 54, 59, 94, 270, 280
  Complaint and proceedings against Oberlin.......................... 14
  Complaint and proceedings against The Ohio and Pittsburg Milk Co..77, 83
  Complaint and proceedings against Ohio Box-board Co..20, 22, 26, 77, 90
  Complaint and proceedings against Van Camp Packing Company....... 63
  Complaint and proceedings against Van Wert......................... 83
  Complaint and proceedings against Victor Stamping Works........... 83
  Complaint and proceedings against Wellston......................78, 83

Berea—
  Water supply for..67, 100

Blanchester—
  Water supply of.. 65

Blue Ash—
  Investigation at 77

Boards of health—
  Annual reports of.. 16
  List of city and village with name of health officer.................... 449

Bourneville—
  Appointment of health officer.. 68

Bowling Green—
  Complaint and proceedings under Bense Act.......................... 83

Bryan—
  Complaint and proceedings under Bense Act...................14, 62, 90

Bucyrus—
  Complaint and proceedings under Bense Act.......................14, 31

C

Cambridge—
  Complaint and proceedings under Bense Act...................20, 26, 77

Canal Dover—
  Appointment of health officer for..................................... 23

Canal Fulton—
  Water supply of.. 82

Carthage—
  Sewerage and sewage purification for......................30, 71, 185

Cedar Point—
  Water supply for...66, 103

Chillicothe—
  Sewerage of 94

Cincinnati—
  Investigation at 78

Collinwood—
  Complaint and proceedings under Bense Act....14, 50, 55, 61, 90, 94, 258

PAGE

Conference of local boards—
    Program for 50, 69
Contagious and infectious diseases..... 5
    Investigation of 77, 84, 85, 86, 92
Contagious diseases—
    Legislation for control of..... 68
Continental—
    Water supply of..... 91
County tuberculosis hospital—
    Approval of plans for Lucas County..... 72
    Approval of plans for Summit County..... 72
    Approval of site for, in Warren County..... 51
    Rules and regulations for..... 23
Covington—
    Sewerage for 52, 191
Crooksville—
    Water supply for.....43, 45

D

Darke County Infirmary—
    Complaint and proceedings under Bense Act.....20, 26
Dayton—
    Additional water supply for.....48, 108
    Complaint and proceedings under Bense Act.....14, 63, 90, 263
    Report on wastes from Aetna Paper Company..... 29
Delaware—
    Additional water supply for.....28, 34, 111
Delphos—
    Complaint and proceedings under Bense Act.....46, 77
Delphos Manufacturing Company—
    Ordered to prevent pollution of Jennings Creek..... 46
Delta—
    Water supply for.....43, 44, 69, 71, 116
Deputy state health officer—
    Legislation for 21, 27
Diphtheria 9
    Examinations in laboratories..... 438
Distributing stations—
    List of 433
District tuberculosis hospital—
    Approval of plans..... 71

E

East Liverpool—
    Water purification for..... 49
East Orwell—
    Investigation of Ohio and Pittsburg Milk Company.....77, 83
Election of officers..... 61
Elmore—
    Complaint and proceedings under Bense Act.....20, 26, 77, 90
    Sewerage for 43, 44, 193

PAGE

Elmwood Place—
    Sewerage and sewage purification for.....58, 196

F

Fostoria—
    Complaint and proceedings under Bense Act.....57, 62
Franklin county tuberculosis hospital—
    Rules and regulations for..... 24

G

Garbage—
    Disposal of 15
Garrettsville—
    Water supply of..... 361
Gas stoves—
    Dangers of unventilated..... 50
General report 5
Germantown—
    Investigation of typhoid fever at..... 88
Girard—
    See Report on Mahoning River..... 286
    Water supply for..... 28
Girls' Industrial Home—
    Inspection of sewage purification plant..... 82
    Investigation of typhoid fever at.....87, 400
    Investigation of unsanitary conditions at..... 395
Greene County Infirmary—
    Investigation of sewerage at..... 89
Greenfield—
    Water supply of..... 81
Greenville—
    Complaint and proceedings under Bense Act.....58, 83
    Investigation of typhoid fever at..... 87
Greenwich—
    Water supply of..... 91

H

Health officer—
    Appointment of, for Canal Dover..... 23
Health officers—
    Approval of 42, 53, 68, 75
    List of city and village..... 449
Hillsboro—
    Water supply of..... 81
Hiram—
    Water supply of..... 365
Holloway—
    Investigation of typhoid fever at..... 89
Huron—
    Change of location of intake.....23, 37, 120
    Water purification for.....37, 122

I

PAGE

- Ironton—
  - Complaint and proceedings under Bense act ... 14, 90
  - Water supply for ... 40, 124

J

- Jackson Township, Pike County—
  - Investigation of smallpox in ... 92
- Jackson—
  - Sewerage for ... 47, 200
- Jefferson—
  - Sewerage and sewage purification for ... 73, 203
- Jennings Creek—
  - Pollution of, at Delphos ... 46, 77
- Jeromeville—
  - Typhoid fever at ... 88

L

- Laboratories ... 15
  - Report of work during 1909 ... 429
  - Report of chief ... 430
  - Number of examinations ... 437
  - Diphtheria ... 438
  - Tuberculosis ... 440
  - Typhoid fever ... 441
  - Rabies ... 442
  - Miscellaneous ... 443
  - Water analyses ... 444
  - Sewage and trades' wastes ... 445
- Lakeside—
  - Water supply of ... 90
- Legislation—
  - For appointment of medical inspectors ... 68
  - For increase in per diem ... 68
  - For medical inspection of schools ... 68
  - For traveling tuberculosis exhibit ... 68
  - For production of antitoxin ... 68
  - For contagious and infectious diseases ... 68
- Letter of transmittal ... 3
- Lewisburg—
  - Water supply for ... 38, 125
- Licenses—
  - Approval of, for maternity boarding houses and lying-in hospitals ... 41, 53, 68, 75
  - Disapproval ... 42, 53
- Lima—
  - Approval of plans for district tuberculosis hospital ... 71
- Linden Heights—
  - Storm water sewers for ... 36, 208
- Lucas county—
  - Approval of plans for county tuberculosis hospital ... 72

PAGE

Logan—
  Water supply for..........73, 129
London—
  Water supply of.......... 81
Long (J. A.) & Company—
  Complaint against, under Bense act.......... 14
Louisville—
  Sewerage and sewage purification for..........34, 209
Lying-in hospitals 15
  See also maternity boarding houses.
Lying-in hospitals—
  Report of inspections.......... 410
Lynchburg—
  Investigation of stream pollution at.......... 85

M

Madison Home—
  Water supply and sewage purification for..........69, 70, 130
Mahoning River—
  Conference in re.......... 13
  Report on an investigation of.......... 286
  General outline of report.......... 288
  Description of stream.......... 288
  Investigation during 1898.......... 292
  Scope of investigation of 1908.......... 293
  Population on watershed..........293, 300
  Methods of conducting investigation.......... 296
  Sources of pollution by domestic and manufactural wastes.......... 302
  Volume of flow of stream.......... 315
  Character of river water and effect of pollution.......... 322
  Self purification 346
  Public water supplies on watershed.......... 351
  Summary 366
  Conclusions 378
  Appendix including analyses.......... 379
Mansfield—
  Investigation of typhoid fever at.......... 88
Marble Cliff—
  Sewerage and sewage purification for..........35, 212
Marysville—
  Complaint and proceedings under Bense act..........20, 26, 78
Massillon Foundry and Machine Company—
  Sewerage for 40, 214
Maternity boarding houses and lying-in hospitals—
  Approval of licenses for..........41, 53, 68, 75
  Disapproval of licenses for..........42, 53
  Report of inspections.......... 410
Medical inspectors—
  Legislation for 68
Medical inspection of schools—
  Legislation for 68

PAGE

Medina—
  Water supply and sewerage of 81
Members of State Board of Health 4
Miamisburg—
  Investigation at 78
Middlefield—
  Request for investigation 23
Middletown—
  Sewerage for 53, 215
Mineral City—
  Water supply of 82
Minerva—
  Water supply of 83
Minutes of Secretary 19
  January meeting 20
  April meeting 30
  June meeting 43
  August meeting 54
  October meeting 58
Minutes—
  Approval of 21, 30, 45, 61
Monroeville—
  Sewage purification for 67, 218
  Water supply of 91
Mt. Gilead—
  Sewerage and sewage purification for 35, 219
Mt. Sterling—
  Investigation of sewerage conditions 79

N

National Association for the Study and Prevention of Tuberculosis—
  Delegate to 33
National Military Home—
  Complaint and proceedings under Bense act 78
New Philadelphia—
  Complaint and proceedings under Bense act 14, 31, 43, 267
  Sewerage for 30, 31, 43, 64
Newton Falls—
  See Report on Mahoning River 286
  Water supply of 359
Newtown—
  Storm water sewer for 27
Niles—
  Complaint and proceedings under Bense Act 14, 54, 59, 94, 270, 280
  See Report on Mahoning River 286
  Sewerage for 21, 34, 221
  Water supply of 361

PAGE

Nuisance—
    Investigation of, at Collinwood.................................... 258
    Investigation of, at Greene County Infirmary.......................... 80
    Investigation of, at New Philadelphia.............................. 267
    Investigation of, at Rocky River.................................... 80
    Investigation of, at Shepards.. 79

O

Oberlin—
    Complaint against, under Bense Act.................................. 14
    Investigation of typhoid fever at..................................... 88
    Sewage purification for...36, 222
Officers—
    Election of 61
Ohio and Pittsburg Milk Company—
    Investigation of 77, 83
Ohio Box-board Company—
    Complaint and proceedings under Bense Act...........20, 22, 26, 77, 90
Ohio River—
    Investigation of 15
Ohio Soldiers' and Sailors' Orphans' Home—
    Sewage purification for...72, 246
Ohio State Reformatory—
    Investigation of typhoid fever at..................................... 89
Ohio State Sanatorium—
    Opening of 11
Oxford—
    Sewage purification for...28, 33
Oxford township, Butler county—
    Investigation of typhoid fever in..................................... 89

P

Perry township, Wood county—
    Complaint against Fostoria.. 57
Pickaway township, Pickaway county—
    Investigation of smallpox in.. 92
Pleasant Hill—
    Water supply for...45, 133
Pleasant Ridge—
    Investigation at 78
Pleasant township, Hardin county—
    Pollution of ditch.. 94
Portage township, Summit county—
    Investigation of nuisance.. 94
Portsmouth—
    Water supply for...33, 52, 138
Privies—
    Rules for construction and maintenance of........................... 38
Put-in-Bay—
    Water supply for...41, 148

R

PAGE

Rabies—
    Examinations in laboratories ... 442
Report of Chief of Laboratories ... 430
Rittman—
    Investigation at ... 77
Roscoe—
    Investigation of typhoid fever at ... 93
Roseville—
    Water supply for ... 43, 45
Rocky River—
    Investigation of nuisance at ... 80
    Investigation of typhoid fever at ... 89

S

Salem—
    Typhoid fever at ... 88
Sandusky—
    Water supply of ... 82
Schools—
    Legislation for medical inspection of ... 68
Scioto River—
    Investigation of ... 80
Sebring—
    Water supply ... 351
Secretary's reports ... 77, 83, 85, 86, 92
Sewage and trades wastes—
    Examinations of ... 445
Sewage purification—
    for Alliance ... 56, 172
    for Archbold ... 51, 180
    for Auglaize county infirmary ... 23, 184
    for Carthage ... 71, 185
    for Elmwood Place ... 58, 196
    for Girls' Industrial Home ... 82
    for Jefferson ... 73, 203
    for Louisville ... 34, 209
    for Madison Home ... 69, 70, 130
    for Marble Cliff ... 35, 212
    for Monroeville ... 67, 218
    for Mt. Gilead ... 35, 219
    for Oberlin ... 36, 222
    for Ohio Soldiers' and Sailors' Orphans' Home ... 72, 246
    for Oxford ... 28, 33
    for Vermilion ... 48
    for Wilberforce University ... 75, 241
    for Warren ... 35, 65, 227
Sewerage—
    for Archbold ... 51, 180
    for Athens ... 52, 183
    for Carthage ... 30, 185
    for Covington ... 52, 191

PAGE

Sewerage—Concluded.
for Elmore 43, 44, 193
for Elmwood Place 58, 196
for Jackson 47, 200
for Jefferson 73, 203
for Linden Heights 36, 208
List of towns investigated 78, 84, 85, 90, 93
for Louisville 34, 209
for Marble Cliff 35, 212
for Massillon Foundry and Machine Company 40, 214
of Medina 81
for Middletown 53, 215
for Mt. Gilead 35, 219
for New Philadelphia 30, 31, 43, 64
for Newtown 27
for Niles 21, 34, 221
for Ohio Soldiers' and Sailors' Orphans' Home 72, 246
for Vermilion 48
for Warren 65, 72, 227
for Wellston 83
for West Lafayette 69, 237
for West Milton 57, 239
for Wilberforce University 75, 241
for Youngstown 46, 241

Shepards—
Investigation of nuisance at 79

Smallpox 5
Investigation of, in Jackson township, Pike county 92
Investigation of, in Pickaway township, Pickaway county 92
Table showing cases and deaths from 6

St. Henry—
Water supply for 39, 149

State Board of Health—
Members of 4
Per diem of members 68

State Homeopathic Medical Society—
Hearing of delegation 21, 27

Street cars—
Evils of high steps 50

Struthers—
Water supply of 353

Summit county—
Approval of plans for county tuberculosis hospital 72

Sunbury—
Investigation of creamery wastes disposal 91

Swanton—
Water supply for 40, 154

T

Tippecanoe City—
Water supply of 81

Toledo—
Water purification for 44

PAGE

Transmittal—
  Letter of ... 3
Trotwood—
  Water supply of ... 82
Tuberculosis ... 8
  Examinations in laboratories ... 410
Tuberculosis exhibit—
  Legislation for ... 68
Tuberculosis hospital—
  Approval of plans for, at Lima ... 71
  Approval of plans for Lucas county ... 72
  Approval of plans for Summit county ... 72
  Rules and regulations for ... 24
Typhoid fever ... 10
  Examinations in laboratories ... 441
  Investigation of, at Batavia ... 87
  Investigation of, at Germantown ... 88
  Investigation of, at Girls' Industrial Home ... 87, 400
  Investigation of, at Greenville ... 87
  Investigation of, at Holloway ... 89
  Investigation of, at Mansfield ... 88
  Investigation of, at Oberlin ... 88
  Investigation of, at Ohio State Reformatory ... 89
  Investigation of, in Oxford township, Butler county ... 89
  Investigation of, at Rocky River ... 89
  Investigation of, at Salem ... 83
  Investigation of, at Wilberforce University ... 79
  Investigation of, at Willoughby ... 88

U

Urbana—
  Water supply for ... 74, 155

V

Van Camp Packing Company—
  Complaint and proceedings under Bense Act ... 63
Van Wert—
  Complaint and proceedings under Bense Act ... 83
Venereal diseases—
  Circular on ... 30
Vermilion—
  Sewerage and sewage purification for ... 48
Victor Stamping Works—
  Complaint and proceedings under Bense Act ... 83

W

Warren—
  See Report on Mahoning River ... 286
  Sewerage and sewage purification for ... 35, 65, 72, 227
  Water supply of ... 353
Warren county—
  Investigation of hospital site for ... 50, 78

PAGE

Warrensville tuberculosis hospital—
  Rules for government of ... 50
Wastes disposal—
  Investigation of ... 92
Water analyses—
  Made in laboratories ... 444
Water purification—
  for East Liverpool ... 49
  for Huron ... 23, 37
  for Toledo ... 44
Water supplies—
  List of, investigated ... 78, 84, 85, 90, 93
  On Mahoning River watershed ... 351
Water supplies and sewerage ... 12
Water supply—
  for Akron ... 39, 64, 254
  of Alliance ... 352
  for Apple Creek ... 30, 51, 98
  of Barnesville ... 30, 31
  of Berea ... 67, 100
  for Blanchester ... 65
  of Canal Fulton ... 82
  for Cedar Point ... 66, 103
  for Crooksville ... 43, 45
  for Dayton ... 48, 108
  for Delaware ... 28, 34, 111
  for Delta ... 43, 44, 69, 71, 116
  of Garrettsville ... 364
  for Girard ... 28
  of Greenfield ... 81
  of Hillsboro ... 81
  of Hiram ... 365
  for Huron ... 23, 120, 122
  for Ironton ... 40, 124
  of Lakeside ... 90
  for Lewisburg ... 38, 125
  for Logan ... 73, 129
  of London ... 81
  for Madison Home ... 69, 70, 130
  of Medina ... 81
  of Mineral City ... 82
  of Minerva ... 83
  of Newton Falls ... 359
  of Niles ... 361
  for Pleasant Hill ... 45, 133
  for Portsmouth ... 33, 52, 138
  for Put-in-Bay ... 41, 148
  for Roseville ... 43, 45
  for St. Henry ... 39, 149
  of Sandusky ... 82
  of Sebring ... 351
  of Struthers ... 353
  for Swanton ... 40, 154

PAGE

Water supply — Concluded.
  of Tippecanoe City 81
  of Trotwood 82
  for Urbana 74, 155
  of Warren 353
  for Willoughby 73, 158
  of Youngstown 355
  for Zanesville 21, 47, 67, 74, 160

Wellston—
  Complaint and proceedings under Bense Act 78, 83

Westerville—
  Investigation of sewage purification plant at 91

West Lafayette—
  Sewerage for 69, 237

West Manchester—
  Investigation at 78

West Milton—
  Sewerage for 57, 239

Wilberforce University—
  Investigation of typhoid fever at 79
  Sewerage and sewage purification for 75, 211

Willoughby—
  Investigation of typhoid fever at 88
  Water supply for 73, 158

Woman's Christian Temperance Union—
  Circular on venereal diseases 30

Y

Youngstown—
  See Report on Mahoning River 286
  Sewerage for 46, 244
  Water supply of 355

Z

Zanesville—
  Water supply for 21, 47, 67, 74, 160